Republic of the Philippines
DEPARTMENT OF SCIENCE AND TECHNOLOGY
ADVANCED SCIENCE AND TECHNOLOGY INSTITUTE

ANNUAL REPORT

2020

DOST-ASTI 2020

CONTENTS

15 MESSAGES

21 HIGHLIGHTS
21 DOST-ASTI Highlights and Accomplishments

25 RESEARCH AND DEVELOPMENT PROGRAM

ONGOING R&D PROGRAMS AND PROJECTS
25 Gul.ai
AI and IoT-Assisted Phenotyping Platform
26 Kooha
A Social Sensing Network Application
26 DOST-ASTI eyes better Standing in CSC's PRIME-HRM as it launches Its Human Resource System Development Project
27 EPDC as Platform for Innovation and Collaboration Program (EPIC) – Project 1: Electronics Product Inclusive Innovation Center (EPIIC)
28 EPDC as Platform for Innovation and Collaboration Program (EPIC) – Project 2: Electronic Products Inclusive Innovation Center (EPIIC) Garage
30 Research and Capability-building in Autonomous and Unmanned Systems (AUS)
31 Remote Sensing and Data Science: DATOS Help Desk
33 Understanding Lightning and Thunderstorms for Extreme Weather Monitoring and Information Sharing (ULAT)
34 Synthetic Aperture Radar (SAR) and Automatic Identification System (AIS) for Innovative Terrestrial Monitoring and Maritime Surveillance Project
35 Ground Receiving, Archiving System, Science Product Development and Distribution (GRASPED)
36 Advanced Satellite for the Philippines Project
37 RuralSync: Providing Digital Content in Remote Communities Through Opportunistic Spectrum Access Project
38 Signal Assessment Using Geospatial Analysis Project

COMPLETED R&D PROGRAMS AND PROJECTS
39 KATUNOG
Year 2: Activities and Milestones
40 Intelligent Data Analysis System Version 1.0
40 Development of Thermal Scanner
41 Optimization of the Operational Capabilities of Hydromet Sensors in Line with International Standards (WMO Standards) for Effective Weather, Flood Warning (CBFEWS) and Application to Research
43 AI-based detection of Social Distancing Violation from CCTVs
43 PastTrack
A Contact Tracing Application
45 Enhancing OneLab for Global Competitiveness

47 TECHNOLOGY TRANSFER PROGRAM
47 Technology Licensing and Commercialization
49 Technical Services
49 Philippine Earth Data Resource and Observation (PEDRO) Center
49 The Computing and Archiving Research Environment (COARE)
50 Philippine Research, Education and Government Information Network (PREGINET)
51 After 20 years, .gov.ph finds a new home in DICT

53 FOREIGN AND LOCAL LINKAGES

FOREIGN LINKAGES
53 DOST-ASTI Space Projects
54 Philippine Research, Education, and Government Information Network (PREGINET)

LOCAL LINKAGES
56 DOST-ASTI Space Projects
56 Philippine Research, Education, and Government Information Network (PREGINET)

59 ORGANIZATIONAL LEARNING AND DEVELOPMENT
59 Process Development
59 Knowledge Development

63 FINANCIAL, HUMAN RESOURCE AND PROCUREMENT MANAGEMENT
63 Financial Performance
64 Human Resources Management

66 ORGANIZATIONAL STRUCTURE
68 Office of the Director
70 Finance and Administrative Division
72 Knowledge Management Division
74 Research and Development Division
76 Solutions and Services Engineering Division
78 Computer Software Division

81 ANNEX

MAJOR FINAL OUTPUTS
81 Technologies Transferred (Commercialized / Diffused)
86 S&T Service Beneficiaries
90 DOST-ASTI Personnel
91 Intellectual Properties Filed / Granted
95 Technical Training Conducted
96 Scientific Papers Published / Presented
97 International Scientific Linkages and Networks
99 External Resources Generated

GLOSSARY

106 DIRECTORY

108 PUBLICATION STAFF

We Create

The DOST-ASTI undertakes research and development to strengthen and modernize the science and technology infrastructure in the country.

We Innovate

The DOST-ASTI develops simple yet cost-effective tools accessible to the local community.

We Collaborate

The DOST-ASTI forges synergy of expertise among its partners in achieving access to technology for the people who need them.

We Educate

The DOST-ASTI continuously aspires to become an intellectual asset to the Filipino community by updating technical competencies through advanced learning.

Vision

The Department of Science and Technology–Advanced Science and Technology Institute (DOST-ASTI) shall be among the leading R&D centers in ICT and Electronics within the Southeast Asian region.

Mission

We are committed to the development of the Filipino society and the Philippines as a nation. We shall contribute to the attainment of national development priorities and the growth of Philippine enterprises by providing innovative solutions using ICT and electronics technologies.

Quality Policy

We commit to generate relevant, timely, and impactful ICT – and Electronics -based R&D innovations, continually improve the effectiveness of our QMS to meet stakeholders' requirements, and comply with existing and applicable legal, statutory and regulatory requirements.

Corporate Objective

- To implement 12 projects per year aligned with the DOST priority agenda.
- To deliver all projects in accordance with client requirements and planned resources.
- To achieve 90% of the targeted number of partnerships with public and private stakeholders and international organizations.
- To achieve 100% Compliance to Legal and Statutory Requirements.
- To achieve an average rating of at least "Satisfactory" in Customer Satisfaction Survey.

Messages

Secretary's Message

Magandang Agham!

I would like to commend the Advanced Science and Technology Institute for its continuous hard work and commitment through its expertise in research and development. Congratulations to everyone for yet another year of achievements in R&D!

We have seen many feats from the DOST-ASTI especially in its efforts centered on Information and Communications Technology (ICT), Electronics Research and Development, and Space Technology. We are proud to say that the institute has again championed these sectors this year, despite the many challenges that came our way in 2020.

In 2020, former Acting Director Dr. Joel Joseph S. Marciano Jr. left his post at the DOST-ASTI as he welcomed his appointment as Director General of the newly minted Philippine Space Agency or PhilSA. With the expertise and professionalism we have seen from him during his stay at the DOST, we are confident that PhilSA will be led in very good hands.

In line with this, the DOST-ASTI was led by a very capable set of leaders who took turns as Officers-in-Charge for the rest of the year. I would like to commend Mr. Alvin E. Retamar, Mr. Peter Antonio B. Banzon, and Ms. Joanna G. Syjuco for a job well done! 2020 was a challenging year for everyone considering the onset of the pandemic, but the DOST-ASTI still managed to exceed expectations through its impressive lineup of technologies this year, particularly those designed to fight our battle against COVID-19.

Some of these include a non-contact Thermal Scanner with medical-grade sensor for temperature monitoring at control points; The prototype of the PastTrack Contact Tracing Application; The COVID-19 Operations Center Monitoring System for LGUs; and the development of an AI-based detection of social distancing violation from CCTV feeds.

These are only a few of the commendable efforts done by the DOST-ASTI in 2020. I hope it continues to achieve more breakthroughs and provide quality service for the Filipino people.

Fortunato T. De La Peña, Ph.D.
Secretary
Department of Science and Technology

Director's Message

Greetings!

The year 2020 was indeed replete with changes for the DOST-ASTI and for the entire country.

The COVID-19 pandemic prompted adjustments - some unprecedented - on how we undertake R&D and manage our operations. In response to the crisis, research initiatives were implemented with heightened urgency and resourcefulness. Crises like this pandemic further highlight the value of our work and the strong sense of duty of our researchers and staff.

We also greeted the year with the announcement of my appointment as the first Director General of the newly established Philippine Space Agency (PhilSA). We considered this as a major development in the space ecosystem in the Philippines to which the DOST-ASTI has contributed substantially over the past several years. The news also meant that I will be leaving as Acting Director of the DOST-ASTI - a position that I have been honored and privileged to hold over the past 4 years. In the meantime, until the appointment of a new Director, the task of leading the DOST-ASTI fell in the very capable hands of our Division Chiefs - Mr. Alvin E. Retamar, Ms. Joanna G. Syjuco, and Mr. Peter Antonio B. Banzon - who each alternately took over as Officer-in-Charge this year. I would like to commend them for their dedication and contributions that ensured the continuity and enhancement of the Institute's programs.

I am deeply proud of how the DOST-ASTI remained steadfast in implementing ongoing programs and in identifying new ones that are able to respond to the country's needs in the pandemic. Throughout this past year, I have seen how our Institute consistently demonstrated its capability to calibrate its innovations process and produce results that help address current and future needs of our country in information and communications technology, microelectronics, and space technology. Through the ASTROS, eXPAND, and ISIP initiatives, our R&D efforts have been infused with new perspectives and have gained new strength. Let us continue to bring the ASTI virtues of ingenuity, perseverance, teamwork and execution ethic to all our efforts and collaborative activities, as this is the best way we can contribute to the robust progress and development of our nation.

Once more, I would like to congratulate the DOST-ASTI management and staff for another year of productive and meaningful achievements.

Mabuhay ang DOST-ASTI!

Joel Joseph S. Marciano Jr., Ph.D.
Acting Director
DOST-ASTI

A Message from the OICs

The onset of the pandemic during the year 2020 has led to several challenges and changes in our everyday lives. However, this did not hinder the DOST-ASTI from doing our part in the advancement of science and technology in the country. It is during these times that DOST-ASTI's role as a research and development institute is needed more by our country and the Filipino people.

We at the DOST-ASTI continued to provide quality services to our partners and stakeholders for research and development projects and programs. Even with a remote work setup for most of the staff, the plans set for the year 2020 were achieved and even led to more linkages that will intensify DOST-ASTI's pursuit of achieving its vision and mission.

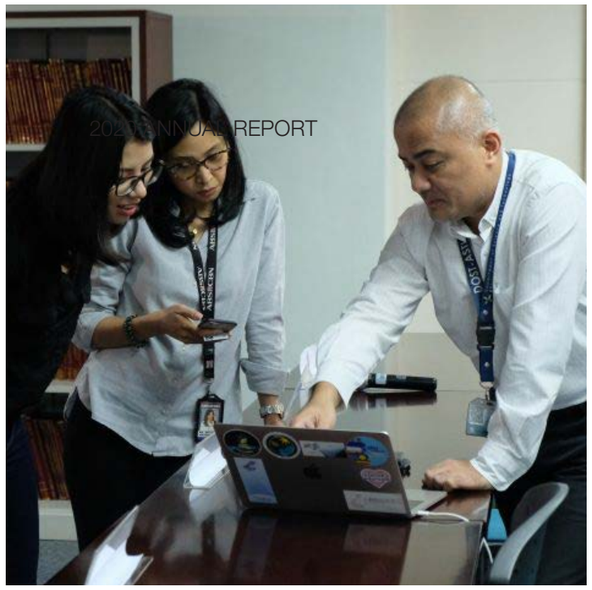
Our researchers and support staff are our main reason for thriving in the field of research and development and we have continued to value their dedication and skills through opportunities that will help enrich their expertise in this field. This has been evident with the initiatives in developing technologies and providing support to help control the spread of COVID-19 in the country was immediately done by our dedicated DOST-ASTI researchers and were ready for use and benefited by the stakeholders and partners as early as the first quarter to first half of 2020.

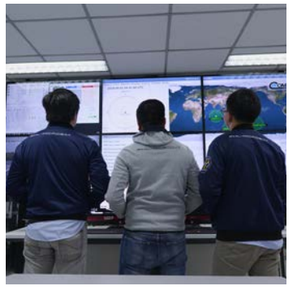
We hope that this report provides our partners, stakeholders, and the general public, a narrative on the commitment we have all witnessed from our researchers and staff members throughout this year. We are very grateful and proud of the camaraderie and excellence we have kept on building overtime within the institute, and we are very excited to see what lies ahead in what seems to be yet another banner year for the DOST-ASTI.

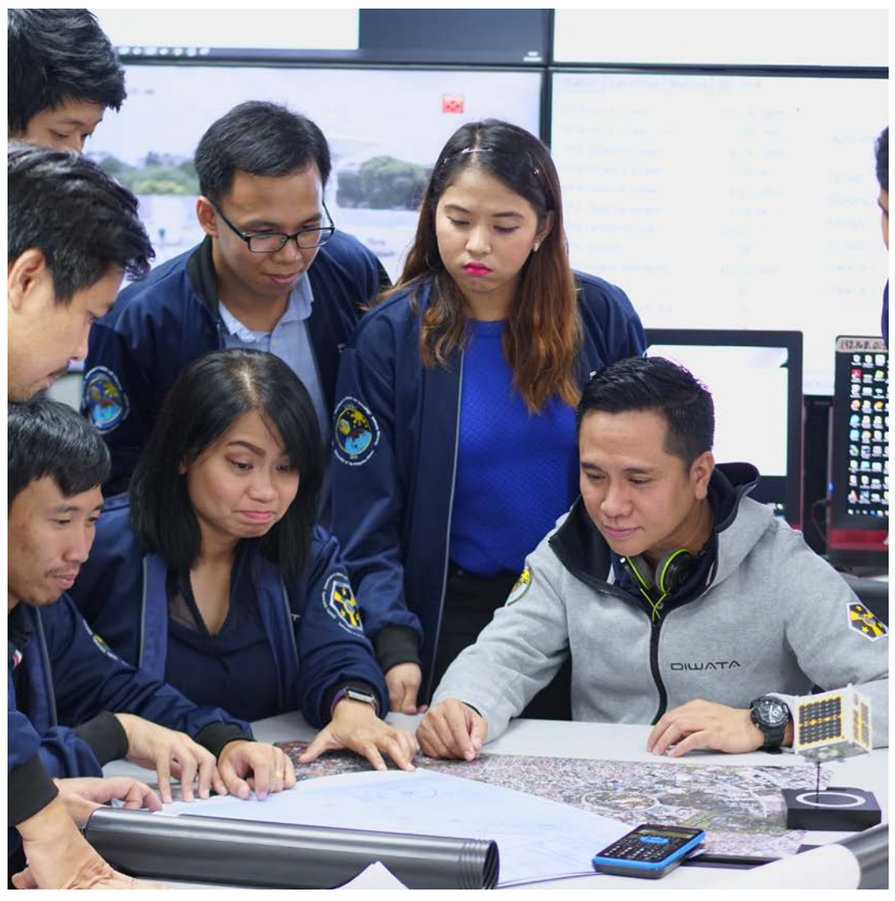
Alvin E. Retamar
Chief SRS
Solutions and Services Engineering Division (SSED)

Joanna G. Syjuco
Chief SRS
Computer Software Division (CSD)

Peter Antonio B. Banzon
Chief SRS
Research and Development Division (RDD)







Highlights

DOST-ASTI Highlights and Accomplishments

Despite the challenges and catastrophic impact caused by the prevalence of the coronavirus disease (COVID-19) in the country, the DOST-ASTI continued to pursue its 2020 plan with the end goal of achieving its commitments and be of service to the sectors that are expected to benefit from its research and development works as well as technical services and assistance. While operating under work-from-home arrangements and maintaining a skeleton workforce, ASTI ensured that the development of ICT- and Electronics- based technologies is sustained; the delivery of technical services to industry, government, and education sectors is not hampered; and the strong ties with local and international stakeholders and collaborators are established and strengthened.

Onboarding of new talents and continuous enhancement of skills and expertise of existing researchers and support staff are of utmost concern. Keeping the interest of high on our new and emerging technologies, and cultivating the organization's core competencies, are very critical in the execution of ASTI's three banner programs: ASTROS (Advanced Space Technology Research, Operations and Services), eXPAND (Environment for Extreme Computing Performance, Networks and Data), and ISIP (Intelligent Systems Innovation for the Philippines).

Space-capable nation by 2040 is the long-term goal of the ASTROS Program. It has been maintaining the Philippine Earth Data Resource and Observation (PEDRO) Center for use in Research and Development (R&D), satellite operations, data processing, and distribution to the government sector. Using the satellite images from PEDRO together with data from ASTI's weather sensors, the Remote Sensing and Data Science: DATOS Help Desk came up with on-demand simulation modeling and analysis using remote sensing (RS) and geographic information system (GIS) tools for various applications such as disaster management, agriculture, aquatic and fisheries, and infrastructure monitoring - among others. Research activities on the Synthetic Aperture Radar (SAR) with Automatic Identification System (AIS) project were also undertaken and terrestrial monitoring and maritime surveillance data were distributed to various government agencies. Among the equally significant initiatives under ASTROS include the Ground Receiving, Archiving System, Science Product Development and Distribution (GRASPED) project which is focused on the operations of the DIWATA microsatellites, and the Advanced Satellite Development project which partners with the Surrey Space Technology Ltd (SSTL) on training and aiding Filipino engineers in the design and manufacture of a multispectral earth observation satellite capable of capturing images of an approximate area of 100,000 km2 of the country daily.

To become a Global Center for Excellence in High Performance Computing (HPC) by 2040 is the vision of the eXPAND Program. In pursuit of this, an advanced computing and networking infrastructure was established and maintained. The RuralSync: Syncing Rural Databases in Public Schools through Digital TV Broadcast project investigated the use of wireless technologies based on TV broadcast signals in updating and distributing educational electronic materials to remote public schools as well as the use of limited TV spectrum for rural connectivity. The Signal Assessment using Geospatial Analysis Project (SAGAP) did a study on how vertical obstructions affect the strength and direction of RF signals and applied the results in the assessment of some areas in the country needing signal coverage. Further, the Understanding Lightning and Thunderstorms (ULAT) Project has been instrumental in establishing real-time lightning observation and monitoring systems in Metro Manila and in some provinces to issue warning for thunderstorms. In partnership with PAGASA, the Optimization of the Operational Capabilities of the Hydromet Sensors for Effective Flood Warning project was completed. In terms of catering to the S&T needs of stakeholders and partners, the DOST-ASTI has also rendered three technical services consisting of the Computing and Archiving Research Environment (CoARE), the Philippine Research, Education and Government Information Network (PREGINET), and the Sustainability of ASTI-Developed Technologies for Meteorological Data Acquisition Stations.

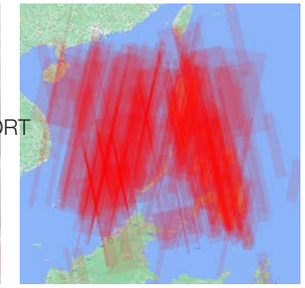
Application of new knowledge and innovation on Intelligent Systems, Systems Research, and Artificial Intelligence across sectors is the primary goal of the ISIP Program. It also intends to catalyze the expansion and transformation of the Electronics Product Development Center (EPDC) to pursue the development of smart electronics-enabled intelligent systems for local and global markets. In terms of technology generation, the Gul.ai: AI and IoT-assisted Indoor Microfarming generates datasets for the

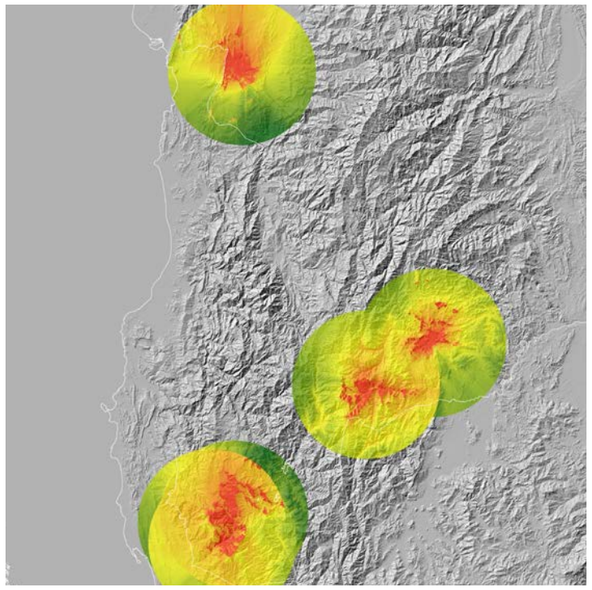
development of machine learning models for predicting some farming statistics such as yield, while the Kooha Social Sensing Network Application carves out a niche for big data generation using available sensors in smartphones and external sensor devices.

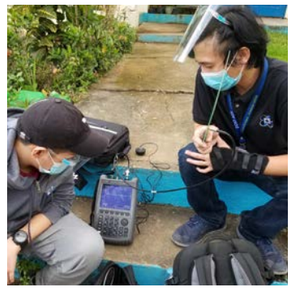
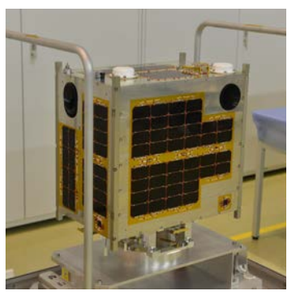
Significant steps were made in developing technology interventions to contribute to the ongoing initiatives against the threat of COVID-19. These include the development of a non-contact Thermal Scanner with medical-grade sensor that can be attached to mobile phones for temperature monitoring at control points; The prototype of PastTrack: A Contact Tracing Application capable of recording patient information and extracting location data to check most visited areas and where recent contact was made; the COVID-19 Operations Center Monitoring System for LGU which can illustrate the interaction between confirmed patients, PUIs, and PUMs up to the barangay level; and the AI-based detection of social distancing violation from CCTV feeds.

Technical services were also rendered to assist various institutions involved in controlling the spread of COVID-19 nationwide. Through the COARE Facility, assistance was provided to help in forecasting possible spread of the virus; Generating valuable insights on the biology, epidemiology, and management of the virus; A supporting a web application that aims to decongest hospitals and target management at the barangay level. PREGINET's high speed network connectivity has enabled hosting of telemedicine endeavors, which fosters the exchange of scientific and medical information between local and international health institutions. Through the PEDRO Facility, collection and dissemination of satellite images that may prove useful in planning and policy making to contain and combat COVID-19 was made possible.

In the years ahead, the DOST-ASTI is expected to carry on and complete its ongoing research initiatives, and sustain the provision of services under ASTROS, eXPAND and ISIP. Coming up are new and challenging projects such as ***"Rescue Operations Assistance MobilE Robots (ROAMER)"***; ***"Resilient Education Information Infrastructure for the New Normal"***; and ***"Leveraging Satellite BUS Development Best Practices and Platform on arQ (arQ 2.0/Level-up)"***, to be implemented with collaborators from the industry, government, and academe. Also in the pipeline is the launch of the Ventilator Validation System. With the milestones achieved and the experience gained in these trying times of pandemic, the DOST-ASTI will strive to generate more innovative solutions for the country to heal and recover as one.





Research and Development Program

Ongoing R&D Programs and Projects

Gul.ai

AI and IoT-Assisted Phenotyping Platform

The Gul.ai project is envisioned to help solve the growing lack of interest of the Filipino youth in agriculture – an issue which may have long term effects in food security in the country. It aims to encourage the Filipino youth to take up areas of study and research, and eventually career paths, that would lead to the fusion of information and communications technology (ICT) and agriculture. Through innovation in this fusion, we will be able to ensure our future generation's food security.

The Gul.ai project's output system is composed of several components: Plantform, a Web Software Application, a Mobile Software Application, and an Application Programming Interface (API) Software Application.

Researchers will be able to design experiments either through the web or mobile application components of the system. These experiments will be physically carried out in the system's Plantform component connected through the Internet. This is where the plants will be grown throughout the duration of an experiment.

Several onboard sensors and actuators in the Plantform that are connected through the internet will be operated throughout the duration of an experiment to ensure the performance of the system with respect to the researcher's experiment design.

Periodic measurement of environmental parameter values and image snapshots of the plants will be gathered from the Plantform to be visualized and made available to the researcher in the web and mobile application components.

This will allow the researcher to remotely monitor the status of the experiment throughout its duration. Results of the experiment will also be made available to the researcher for documentation and reporting purposes.

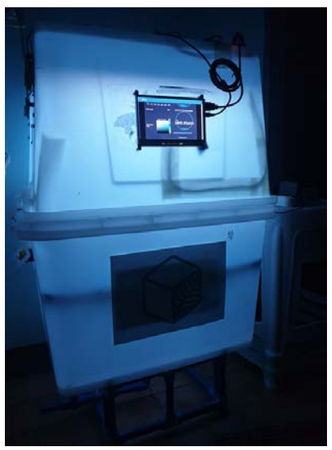


Figure 1. *Gul.ai Plantform Version 1.0.*

Figure 2. *Gul.ai Plantform Version 1.0 Misting System.*

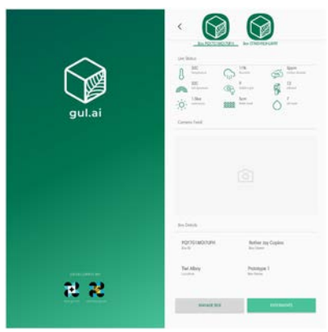


Figure 3. *Gul.ai Mobile Application Version 1.0.*

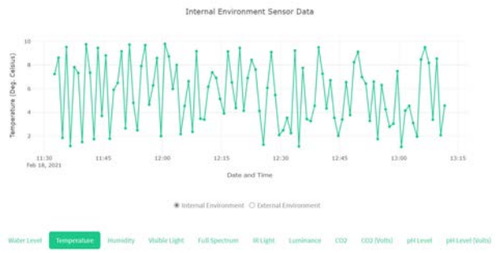


Figure 4. *Gul.ai Web Application Version 1.0 - Experiment Details View.*

Figure 5. *A step-by-step procedure on how the Kooha mobile application works.*

Initial target adopters of the system are secondary level schools and agricultural colleges in the country. The product can also be licensed to interested private companies for mass production and distribution to the general population. The copyright registration of the web and mobile application documentations is also in place.

Kooha
A Social Sensing Network Application

With its aim to create a potential niche for big data generation to address insufficiency of available real-time IoT-generated data to perform data analytics, DOST-ASTI's Kooha team released the beta version of their ongoing mobile app development: Kooha. It was made available in Google Play last December 2020, while its web app counterpart can be accessed through https://kooha.asti.dost.gov.ph.

TheKoohamobileandwebappswere presented to various (web) conferences such as the TLO-initiated Stakeholder's Meeting which was conducted and facilitatedbytheDOST-ASTI'sTechnology Licensing Office (TLO); the 2020 National Science and Technology Week (NSTW); and webinars organized by DOST Regional Offices. These events were all attended by Kooha's potential users and stakeholders.

The Kooha mobile application is designed for crowdsourcing of images, sensor data, and other metadata; while the web application is a platform to view shared photos from the mobile app users. The Application Programming Interface (API) gateways will be developed to allow access of data to potential research partners for data analysis and development of potential applications.

The Kooha technology has an ongoing patent application entitled System and Method for Real-Time Participatory Data Collection dated August 24, 2020. Also, trademark applications for Kooha have been approved for publication in the Official Gazette last 30 July 2020.

Kooha as a Breakthrough in R&D

Kooha is labeled as a societally-relevant and responsible social sensing network application that makes it easier to contribute data and be connected to the research community. Through Kooha, information gathered can help various sectors curate data for research purposes. This cost-effective solution addresses technical challenges in adopting an IoT application such as infrastructure, connectivity, reliable power supply, and data center.

The Kooha project will contribute to the enhancement and development of skills and expertise in the field of S&T by allowing academe, public and private sectors, and research institutions to use generated data for advanced diagnostic analytics.

DOST-ASTI eyes better Standing in CSC's PRIME-HRM as it launches Its Human Resource System Development Project

The DOST-ASTI recognizes that manpower is one of the key assets of any organization, and therefore should be given proper attention. Unfortunately, human resource management (HRM) can be compromised in particular when many of its processes are not manual, streamlined, and properly implemented.

In line with the DOST-ASTI's goal of continuous improvement to achieve better standing in the Civil Service Commission's HRM maturity classification under its Program to Institutionalize Meritocracy and Excellence in Human Resource (PRIME-HRM), the agency launched a project that aims to review and automate the agency's HRM processes.

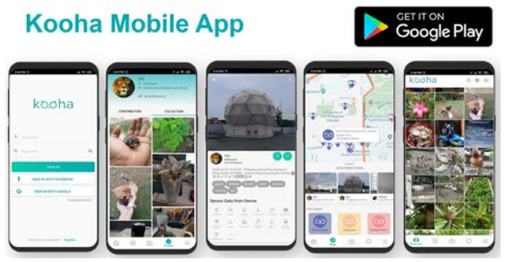


Figure 6. *Actual screenshots of the Kooha mobile application. The beta version of the application can be downloaded from the Google Play Store.*

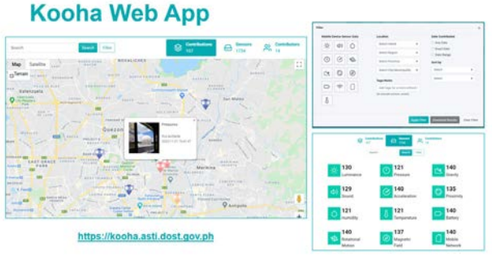


Figure 7. *Kooha web application features. The online portal can be accessed through https://kooha.asti.dost.gov.ph.*

In 2020, the Institute started the development of the Human Resource Information System focusing on one of the four HR Core Systems – the recruitment, selection, and placement core system. By the end of the year, 90% of the recruitment, selection, and placement modules were completed.

A portal where applicants can submit applications on published government vacancies has likewise been developed. Unlike similar applications in the market, the DOST-ASTI's HRIS is built on a technology stack that allows improved security and system performance; and when used by other government agencies, it shows better visibility and analysis of consolidated HR data of the Philippine Government. This also means faster reporting and monitoring, and improved decision-making in relation to Civil Service data.

With the implementation of the HRIS in DOST-ASTI, the Institute targets to climb by a notch or two in the PRIME-HRM. Currently, the DOST-ASTI is at level one or Transactional HRM wherein, as defined by CSC, *"HR assumes personnel function that is mostly separate from agency/business and talent needs."*

EPDC as Platform for Innovation and Collaboration Program (EPIC) – Project 1: Electronics Product Inclusive Innovation Center (EPIIC)

Established in 2015, the Electronics Product Development Center (EPDC) continues its upgrade and delivery of services with two (2) additional services: The Ventilator Validation System and the Integrated Wet Process PCB Fabrication System.

For the Ventilator Validation System, the EPDC and the DOST-ASTI's co-implementing agency Electronics Industries Association of the Philippines, Inc. (EIAPI), developed a Breath Simulator to assist in the development and testing of local ventilators in response to the COVID-19 pandemic. It was set up to test and validate the development of low-cost ventilator prototypes from the local industry and local universities that the DOST supports to address the need for life-saving ventilator equipment at healthcare facilities. This testing service will provide permanent support not just to prototype developers but also to existing commercial ventilator manufacturers with a complete solution for validating new medical -grade ventilator products intended for human use.

The developed Breath Simulators are now able to run in Assist Control, Volume Mode. The ventilator controls the timing of the breath cycle in this Ventilator initiated Mandatory (VIM) breath. The Breath Simulator follows the ventilator, acting as the patient's lungs.

The parameters on the Patient Initiated Mandatory (PIM) breath were being tested for stability, where the Breath Simulator gives out a spontaneous breath at the specified Respiratory

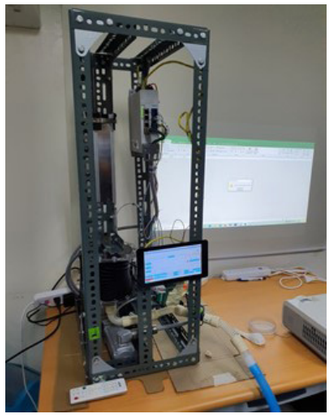


Figure 8. *Breath simulator prototype.*

Rate (RR) and the ventilator follows up or assists with a support volume of air each time. The Breath Simulator will undergo safety, EMC, and susceptibility tests, before being used on the floor for testing incoming ventilators.

The establishment of the 2nd line rapid prototyping upgrade, also called the Integrated Wet Process PCB Fabrication System, will improve the quality of the Printed Circuit Board (PCB) fabrication, increase the production capacity in terms of size of PCBs, number of layers, plated through-hole material, and choice of surface finishes and allow other process options needed by PCB fabrication clients. This facility is for renovation and is expected to be completed by the 1st quarter of 2021.

EPDC was envisioned to spur the growth of the local electronics industry through relevant services through PCB Fabrication, PCB Assembly, 3D Printing, Parametric Testing, Product Safety Testing, Electromagnetic Compatibility (EMC) Testing, and conduct of seminars

Figure 9. *For the year, EPDC was able to provide services to various sectors.*

and trainings. Together with EIAPI, EPDC manages the continuous upgrade and delivery of these services.

During the pandemic, EPDC provides services that would contribute to the national efforts on COVID19-related initiatives. The EPDC supported schools with ventilator projects and the development of a Thermal Scanner with its testing facilities that are in place – the EMC testing which has gained ISO 17025:2017 in 2019 by the American Accreditation for Laboratory Accreditation (A2LA). A2LA is an independent, non-profit, internationally recognized accreditation body in the United States for laboratory and laboratory-related accreditation services.

Adapting to the new normal, EPDC also conducted the Smarter Living Trends webinar in partnership with Infineon Technologies last September and Basic PCB Design using KiCAD software with 200 attendees from prospective clients from the industry and academe last December.

A total of PHP 2,156,391.13 revenue has been generated from the 49 served clients for EMC laboratory and Electronic Prototyping Product (EPP) laboratory, giving a total number of 111

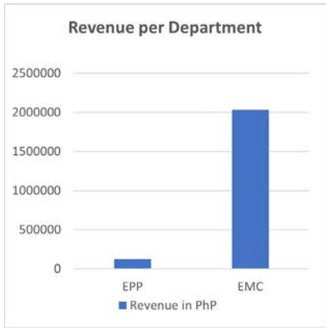


Figure 10. *A total of PHP2,156,391.13 revenue is generated from the 49 served clients for EMC laboratory and Electronic Prototyping Product (EPP) laboratory.*

tests and 230 PCB boards fabricated and assembled. EPDC also continues to expand its network with formed partnerships with Underwriter Laboratories (UL) – a global safety certification company in the United States – and the Department of Transportation for the AFCS Project. It has also rekindled talks with NTC for type approval testing, and assistance to the STAMINA4Space project of the University of the Philippines Diliman.

EPDC as Platform for Innovation and Collaboration Program (EPIC) – Project 2: Electronic Products Inclusive Innovation Center (EPIIC) Garage

Research and development will not be possible without the collaborative efforts of the Electronics Product Development Center (EPDC) and the innovative minds of key individuals from the academic, government, and private sectors. Its significance is much perceivable as the project highlights products that aim to resolve the challenges faced by the health sector during this pandemic.

Interest in developing locally made ventilators substantially increased as the promise of government support was assured. To further ensure that the proposed ventilator units are already suitable for medical-grade application and human use, the research team under the supervision of EPDC operations head Engr. Victor Gruet, initiated the development of Breath Simulator. This is an electronic device developed to simulate the breathing pattern of a patient's lungs once assisted by a ventilator. This works together with the ventilator validation system to verify its safety and performance. Currently, the breath simulator is undergoing electromagnetic compatibility tests to confirm its compliance as an electronic product, as part of the final testing phase.

With its objective of delivering a more extensive approach in monitoring the health conditions of allowed persons outside a residence, the researchers under the team led by Engr. Gerwin Guba proposed a wireless-contact thermal scanner, operating in both conventional (manual) and automated mode. With the support of EPIIC Garage, the team was able to produce 16 units. Additionally, the thermal scanners acquired sensor calibration certificates from the National Metrology Division of the Industrial Technology Development Institute (DOST-ITDI), as well as EMC acceptability and compliance approved by EPDC.

Not only did the institution strive

Figure 11. *Thermal Scanner Model No. IR1PBLE01.*

to explore innovative solutions that will help directly address the necessity of the community in terms of health and safety, but it also opened a plethora of opportunities to maximize technological applications to aid and improve other vital needs of Filipinos especially in these trying times.

The advent of communications has proven to be one essential factor of communities globally, bringing up the idea for RuralSync, a project studied and developed by Engr. Calvin Hilario and his team. RuralSync is a low-cost Integrated Services Digital Broadcasting-Terrestrial (ISDB-T) receiver that can be plugged into personal computers to access files and electronic information, showcasing the potential of digital television frequencies as an effective tool for exchanging information and reaching most areas inaccessible by Internet connectivity. The project was successfully reviewed by the technical parties and its latest prototype – Beta version is now in the process of submission to the fabricating entity. Currently,

Figure 12. *3D view of ISDB-T USB Receiver Beta.*

the team is also discussing with its affiliated government agencies, NTC, and DepEd potential partnerships. Moreover, the project now reaches the software development phase and is also working on preliminary testing and site survey.

As intelligent energy management systems and Internet-of-Things (IoT) technologies rise, the DOST-ASTI, through a research team under Engr. Emmanuel Balintec developed its own version of an off-grid Smart Streetlight featured with computer vision compatibility for a more refined and accurate response of light intensity and duration. It also serves as a platform for additional sensors for comprehensive monitoring. As of May 2021, the team has successfully submitted its BOM, and is now working on the software requirement of the project.

Aside from its Research and Development projects, EPIIC Garage was also able to provide a PCB Design Service for De La Salle University's DOE Project (Wearable Goat Peak Estrus Sensor). This device makes it easier for farmers and goat breeders to monitor the goat's readiness for artificial insemination. The service gave a revenue of 11,695.50 with a 20% discount applied for academic clients.

EPDC also has a new set of Sales & Marketing and EPP staff. A training on PCB Assembly (12-13 October 2020) and PCB Fabrication (21 October 2020) services were conducted by Engr. Krizzie Keith Marie Benzon, a former Science Research Specialist II of Project 1 - EPDC Laboratory. A total of five (5) staff members were trained for these services.

Two seminars were also provided virtually:

- FEU's 7th National Virtual TechnoFest 2020 with 75 participants conducted on 30 October 2020
- WOCEE Wired Tech Talk with 274 registered participants in Zoom and 238 viewers via Facebook Live. This was conducted on 20 November 2020.

Research and Capability-building in Autonomous and Unmanned Systems (AUS)

The Research and Capability-building in Autonomous and Unmanned Systems (AUS) project aims to contribute to the autonomous and unmanned systems research in the Philippines through the expansion of the agency's knowledge and capability in developing autonomous/unmanned platforms (e.g., wheeled rovers, underwater and aerial drones, etc.) that are incorporated with technologies such as Artificial Intelligence. The project also aims to enhance the agency's capability in designing, developing, and integrating various payloads into the platforms, including environmental sensors, cameras, tracking antenna, etc.

Knowledge and capability in designing, building, maintaining, and operating autonomous and unmanned systems and payload modules

The team participated in the 2020 National Science and Technology Week (NSTW) through a webinar entitled *"Robot Operating System (ROS) Webinar and Demo."* During the said event, the team discussed an overview of what ROS is and its roles in a robotic system. They also demonstrated the basic ROS capabilities, including remote control operation and Simultaneous Localization and Mapping (SLAM).

Mobile Robot/ROS and Computer Vision/AI

The team has finished building two off-the-shelf platform robots, specifically the Turtlebot3 Waffle Pi and Burger. Both platforms are used for learning ROS, testing ROS capabilities, and evaluating the differences between various ROS flavors. The platforms were also replaced with external parts, such as replacing the Raspberry Pi single-board computer (SBC) with Jetson Nano, for better performance. Using a Jetson Nano development kit, the team tested several pre-trained machine learning models for object detection. The models were later integrated with ROS and tested on the Turtlebot3 platforms.

Payload and Accessory Development

Environment Sensor Pack POC with Thingsboard as Sensor Data Repository Platform

The team built some environment

Figure 13. *Autonomous and Unmanned Systems (AUS) tracking antenna Proof-of-Concept (POC).*

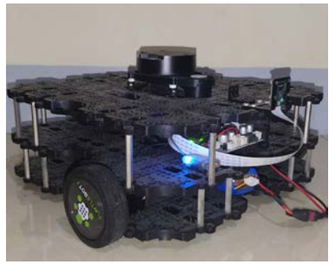


Figure 14. *Autonomous and Unmanned Systems (AUS) Turtlebot 3 Waffle.*

sensor packs that include sensors for temperature, humidity, ambient light, and air quality. Afterward, the team finished setting up the Thingsboard IoT platform (both for development and production) as a means of gathering data from hardware sensors. A dashboard has also been configured to view the incoming data. Collaboration with an Analytics team for data analyzation was done as well.

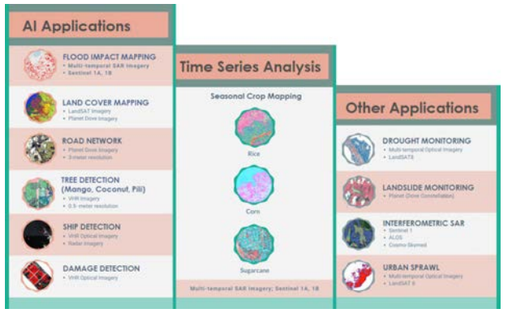


Figure 15. *DATOS applications.*

Figure 16. *DATOS Memorandum of Agreement signed.*

Long-range Tracking Antenna Mount Prototype

The team designed a long-range tracking antenna system to extend the range of communication between unmanned systems and controller or ground station. It is used for telemetry and control, as well as other data such as video and audio. A prototype was built using wooden materials.

Remote Sensing and Data Science: DATOS Help Desk

Befitting the DOST-Advanced Science and Technology Institute's commitment to provide innovative solutions and quality products and services for its stakeholders, the Remote Sensing and Data Science: DATOS Help Desk, upon the Technical Panel's recommendation during the DOST Space Technology Applications (STA) Panel Evaluation, has continued its operations as one of DOST-ASTI's in-house services even after its conclusion on 29 February 2020.

Months following its completion, DATOS has gone above and beyond its pursuit to explore ways to improve its products, continuously devising new applications intended to complement the decision-making and operational activities of various government agencies and potential partner institutions.

The project has R&D initiatives on advanced methodologies for earth-observation (EO) and geospatial data, integrating Artificial Intelligence (AI) and other image processing techniques to develop space technology applications designed to improve traditional mapping methods and stimulate fast and efficient nationwide map generation. DATOS products are generally categorized into three, based on the processing methodology used:

- AI Applications, which utilize AI-models trained to automatically detect object or feature from satellite imageries.
- Those implementing Time Series Analysis, which involves sequential temporal signature observation of seasonal crops using radar satellite images.
- Other Applications, which include derived products that employ other processing techniques falling under neither of the first two main categories.

Through the course of its implementation even until its completion, DATOS has undertaken a total of six (6) Memoranda of Agreement (MOA):

- Sugar Regulatory Administration.
- Bataan Peninsula State University.
- National Mapping and Resource Information Authority.
- Department of Agriculture - Food and Agriculture Organization.
- Bureau of Fisheries and Aquatic Resources.
- Philippine Statistics Authority.

Five (5) of which were signed during the implementation period while the last one with PSA was signed in August 2020 after the project's official conclusion.

Despite the challenges brought by the COVID-19 pandemic and the announcement of the enhanced community quarantine (ECQ) in March 2020, DATOS has carried out its operations by mobilizing a business continuity plan in accordance with the work-from-home (WFH) arrangement implemented by DOST-ASTI within the team.

DATOS has proactively engaged in various activities organized to support community response against COVID-19. As part of the DOST-ASTI's monitoring initiatives during ECQ, the DATOS team together with the Philippine Earth Data Resource Observation (PEDRO) Center, has deployed ***"before-and-during"*** satellite images of some of the identified areas of interest (AOIs) in the country.

The team has also hosted various events and technology transfer activities (pre- and during ECQ), which formed part of the DATOS' information, education, communication (IEC) campaigns and initiatives for 2020.

DATOS has also partnered with the Philippine Space Agency, STAMINA4Space, and NASA Space Apps Challenge to conduct the fourth iteration of the Data Science Kapihan series titled ***"Data Brew 4: Space and Ground Data for the Betterment of the Human Condition"***.

Held on 07 October 2020, the event was organized in celebration of the World Space Week 2020. Consistent with this 2020 theme ***"Satellites Improve Life,"*** Data Brew 4 aimed to bring together individuals, researchers, leaders, and space enthusiasts for an in-depth discussion of how space technology and ground data are used to improve human condition — especially during the current COVID-19 pandemic.

The team has conducted five (5) trainings and capacity building activities for the year, and has served a total of 52 agencies and units. Among these organizations, 51 were from the government sector, and one (1) from the academe.

Throughout its implementation,

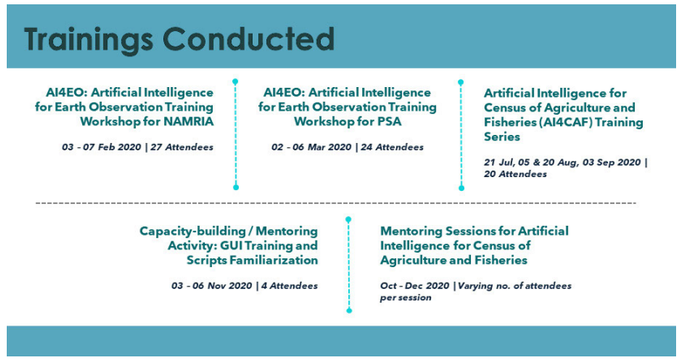


Figure 17. *DATOS trainings conducted.*

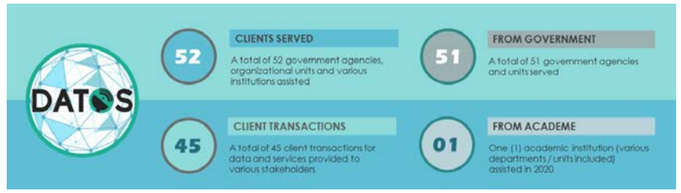


Figure 18. *Summary of DATOS clients and transactions.*

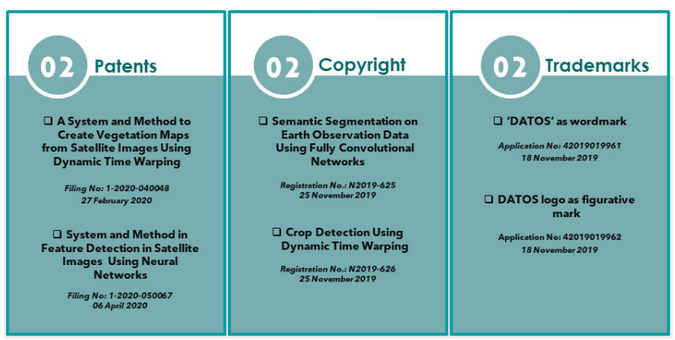


Figure 19. *DATOS Intellectual Properties.*

DATOS has processed a total of six (6) Intellectual Property (IP) applications. Two (2) copyrights and two (2) trademarks were filed the previous year, while additional two (2) patents were registered this year.

Figure 20. *IDC 2020 SCAPA poster showing DATOS as one of the finalists.*

The team has published two (2) papers which were both submitted to the XXIV International Society of Photogrammetry and Remote Sensing (ISPRS) Congress:

1) Sugarcane Plantation Mapping Using Dynamic Time Warping from Multi-temporal Sentinel 1-A Radar Images - ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences; Volume V-3-2020; 03 August 2020)
2) Near-real-time Flood Detection from Multi-temporal Sentinel Radar Images using Artificial Intelligence - The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences; Volume XLIII-B3-2020; 22 August 2020.

During the year, DATOS was also shortlisted as one of the finalists for the Public Safety- Disaster Response/ Emergency Management category in the International Data Corporation's (IDC) 2020 Smart City Asia Pacific Awards (SCAPA). With the program focused on showcasing cutting-edge initiatives that allow government leaders to transform their cities through the derived technologies, the nomination recognizes DATOS' contribution in the disaster risk and reduction management (DRRM) efforts in the country.

DATOS was the only project from the Philippines nominated for the year.

As a summary, the DATOS team members continually work to satisfy the increasing demands on value stream mapping to support and complement the current initiatives and efforts of researchers from the national government agencies, academic institutions, and other partners using science-based approach for DRRM and other applications.

Understanding Lightning and Thunderstorms for Extreme Weather Monitoring and Information Sharing (ULAT)

The ULAT Project puts together a forecasting technique to accurately predict weather at a shorter time period using lightning and thunderstorm events. A network of lightning detection devices is installed all over Metro Manila and in select DOST-PAGASA Weather Stations to collect lightning and weather data. With these data, along with complementary climatology studies and use of satellite images, the team develops the formula for ***"now-casting"*** prediction.

In 2020, the project has accomplished the following:

- Deployed 34 P-POTEKA stations in Metro Manila and six (6) V-POTEKA stations nationwide.
- Ongoing development of short-term forecast method.
- Ongoing development of sensor data sharing platform.
- Established satellite antenna for 3D structuring of thunderclouds.
- Preparation for the improvement of the server room and operations center and maintenance of the 3.5 satellite antenna in Dumangas, Iloilo.
- Provided data access request for weather and lightning data to interested stakeholders.

For 2021, the team is focused on completing its own lightning detection prototypes, catch up on delayed fieldworks due to the pandemic, conduct continuous assessment of the POTEKA lightning data to integrate to PAGASA's

lightning detection system, and fine tune methodologies and algorithms for short-term forecasting of rainfall and thunderstorms.

Other activities include the improvement of the ground receiving station (GRS), operation of the satellite antenna in Iloilo, and the integration of the ULAT visualization portal to the DOST-PAGASA's website.

The ULAT project is the local counterpart of a five-year research collaboration between Hokkaido University (HU) and the DOST-ASTI. The initiative is in cooperation with the Japan International Cooperation Agency (JICA) and Japan Science and Technology (JST) agency through the Science and Technology Research Partnership for Sustainability Development (SATREPS) Program. It is also co-implemented by the University of the Philippines - Institute of Environmental Science and Meteorology (UP-IESM) and the DOST-Philippine Atmospheric, Geophysical and Astronomical Services Administration (DOST-PAGASA).

Synthetic Aperture Radar (SAR) and Automatic Identification System (AIS) for Innovative Terrestrial Monitoring and Maritime Surveillance Project

The Synthetic Aperture Radar (SAR) and Automatic Identification System (AIS) for Innovative Terrestrial Monitoring and Maritime Surveillance (SAR with AIS) Project that started in 2018 aims to improve terrestrial monitoring and maritime surveillance over high priority areas through the simultaneous input of SAR imaging and AIS data. The data can also be used for various applications such as disaster management, environmental and agricultural monitoring, and land cover classification, among others.

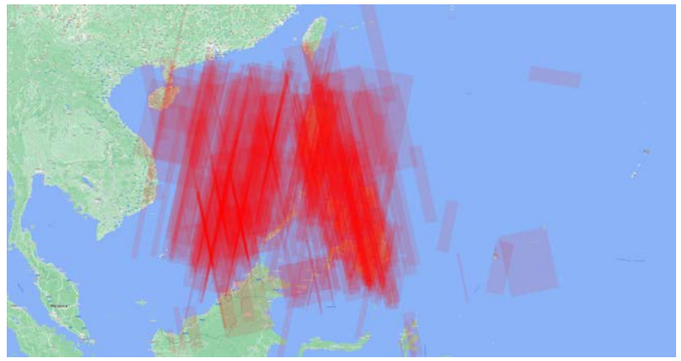


Figure 21. *Screenshot of the SIYASAT Portal showing the coverage of all radar images captured by NovaSAR-1 satellite from start of service to 30 March 2021.*

In August 2019, the DOST-ASTI signed an agreement with Surrey Satellite Technology Ltd. (SSTL). This partnership equipped the country 10% of the imaging capacity of the Synthetic Aperture Radar (SAR) NovaSAR-1 satellite. This roughly translates at least two minutes of imaging per day covering up to 81,600 sq. km.

On 13 October 2020, the project was officially launched through a virtual press briefing with a theme *"Bantay ng Yamang Lupa at Karagatan Mula sa Kalawakan."* The online event was attended by officials, stakeholders, and the press.

The press briefing introduced the project to the public through a series of presentations and discussions of its objectives and the technology behind the NovaSAR-1 satellite. It also featured a demonstration of the Surveillance, Identification and Assessment using Satellites (SIYASAT) Portal, the official distribution portal of the project.

The SIYASAT Portal caters to 75 registered users from several government agencies that can access the portal. Many task requests cover West Philippine Sea, Scarborough Shoal, Palawan, and the Metro Manila region for ship and structure detection. The SIYASAT Portal also gives access to 824 images covering our country's land territory. There are also image captures on some parts of Brunei, Malaysia, Indonesia, Singapore, Palau, Vietnam, China, Australia, and South Africa.

Archived AIS data can now also be visualized on the SIYASAT Portal. It also allows for simultaneous visualization of available radar and AIS data. The project is also working on the integration of ship and object detection to the portal.

An online training was also held for the technical staff and project partners on earth observation satellites and synthetic aperture radar hosted by the Surrey University and the Surrey Space Centre. The first installment from 03 November 2020 to 07 December 2020 dealt with the theory of synthetic aperture radar imaging and basic applications of using radar images. The second part of the training on applications of radar images and AIS data for maritime domain awareness, and the third part which will tackle advanced SAR remote sensing techniques – specifically on radar interferometry and polarimetry – will both be held in 2021.

The following experiments are still underway since relevant data and SAR processing software are still under installation:

- Utilize Interferometric SAR (InSAR) and Persistent Scatterer SAR (PSInSAR) to quantify land subsidence and create latest digital elevation models.
- Recent methods for oil spill detection, specifically using artificial neural networks.
- Biomass estimation and detect presence of logging by utilizing change detection techniques.
- Evaluate port traffic and customs collection by detecting unusual patterns in ship tracks.

Ground Receiving, Archiving System, Science Product Development and Distribution (GRASPED)

The DOST and University of the Philippines Diliman (UPD)'s Space Technology Applications Mastery, Innovation, and Advancement (STAMINA4Space) Program's Project 4, also called the Ground Receiving, Archiving System, Science Product Development and Distribution (GRASPED), oversees the continuous operations of the Philippine microsatellites.

Implemented by the DOST-ASTI, the GRASPED Project performs satellite mission planning, image distribution, data processing, satellite assessment, and public relations. Through these activities, the operations of the satellites as well as distribution of satellite data, will be in place.

On 06 April 2020, the country's first microsatellite Diwata-1 satellite re-entered the Earth's atmosphere, marking the end of its almost four-year mission in space. From January to March of 2020, Diwata-1 downloaded a total of 842 megabytes of data and recorded 79% of its downloads successful, while 21% of the attempts failed.

Throughout Diwata-1's lifetime, the microsatellite passed by the Philippines around 4,800 times, covered roughly 38.0% of the country's land area (114,087 km. sq.) and orbited the earth approximately 22,643 times.

After Diwata-1's decommissioning, the GRS now caters to the operation of Diwata-2 alone. As of 31 December 2020, Diwata-2 had 251 out of 281 successful data uploads (89.3%) with only 30 (10.7%) failed data uploads.

For Diwata-2's data download as of the end of December 2020, a total of 446 out of 503 (88.7%) download attempts from the Diwata-2 were successful, with 14 partially successful attempts (2.8%) and only 43 attempts (8.5%) that failed.

Diwata-2 captured roughly around 25,000 images that year and covered 82.83% of the country's land area (248,489.3 sq.km.) since its deployment in 2018.

Through the GRASPED Project, the DOST-ASTI aims to develop a ground-based device capable of store and forward mission proof of concept satellite data transmission. The device – GST (Ground Sensor/Station Terminal) – will be deployed remotely to gather data from the environment. Data from this GST will be sent and stored to the satellite when it passes thru GST's horizon then forwarded to the Ground Receiving Station (ARSS-UP) by commanding the satellite to download the data gathered from the GST.

In 2020, the team coordinated with the BIRDS Project regarding the changes made in the store and forward mission's transition from Diwata-2 and Maya-1 to the new cube satellite Maya-2. The mission will be tested in 2021, upon the release of Maya-2 in space.

The team also completed the development of a satellite telecommand and telemetry system in a software defined radio platform. This prototype will provide a low-cost alternative to the more expensive off the shelf demodulators that are currently being used for the Diwata operations. Since the platform is software implemented, it will have the flexibility to cater to different operational requirements for present and future satellites. Testing activities will be conducted in 2021.

Advanced Satellite for the Philippines Project

The Advanced Satellite for the Philippines (ASP) envisions the enhancement of the information and communications technology (ICT) infrastructure fabric of the country through the development and utilization of satellites and relevant space technologies by building, launching, and operating a constellation of satellites for the Philippines based on the advanced satellite platform. The constellation or network embodies the *"Build, Build, Build in Space (B3iS)"* initiative of the Philippine Space Agency (PhilSA) that contributes to vital national infrastructure for providing spaceborne information and services, and industry-building.

In this endeavor, the country will be able to gain access to the complete underlying satellite design and technologies through licensing from the Surrey Satellite Technology Ltd., which will enable the rebuilding, customization, and local manufacturing of our own satellites. This approach ensures the transfer and retention of knowhow in the Philippines that will further strengthen the country's space technology portfolio and bolster the local space industry as a pathway for economic recovery post-COVID-19.

The ASP is a project by the DOST and University of the Philippines Diliman (UPD)'s Space Technology Applications Mastery, Innovation, and Advancement (STAMINA4Space) Program. It is implemented by UPD and the DOST-ASTI in coordination with the Philippine Space Agency (PhilSA).

The ASP project is a partnership with Surrey Space Technology Ltd (SSTL). The collaboration entails training and aiding Filipino engineers in the design and manufacture of a multispectral earth observation satellite capable of capturing images of an approximate area of 100,000 km2 of the country daily.

On 14 December 2020, the first phase of the activity commenced with the remote delivery of the Satellite System Design course by the University of Surrey, which was attended by a pool of 30 Filipino Engineers. Another set of courses and lectures on systems engineering will be delivered by the SSTL in 2021 to further equip our engineers with theoretical knowledge needed to build our next satellite. Out of the 30 engineers, 13 of them will be deployed to SSTL in the UK for full immersion on the design and manufacture of our next satellite.

To provide an overview and background on the activity's initial phase and timeline, SSTL hosted the Kick-Off Meeting on 22 December 2020. It was attended by representatives from UPD, DOST-ASTI, DOST-Philippine Council for Innovation, Energy, and Emerging Technology Research and Development (DOST-PCIEERD), and PhilSA.

Phase 1 of the project focuses on mission definition and satellite design. During the first quarter of 2020, various stakeholders in the country were consulted for the ASP Project. Phase 2 of the project will be led by PhilSA to continue the building and launching of the satellite as well as retention and utilization of the know-how gained through this collaboration.

The ASP project continues to build on top of the capabilities brought by Diwata-1 and Diwata-2. This commercial-grade satellite with SSTL will provide timely high-resolution images of the Philippines, from which actionable insights can be made to aid decision-making in agriculture, disaster management, national security, and coastal monitoring and ocean studies. Initially, the ASP project had set the launch in 2022. However, due to the development of the UK COVID-19 strain, the expected launch year of the satellite has been moved to 2023.

Figure 22. *Sample application (Interactive quiz) transmitted through digital TV broadcast signal.*

Figure 23. *RuralSync technical Staff working on the tuner and demodulator prototype.*

Figure 24. *Actual pictures taken during site surveys in Pinagsabiran ES, Madilay-Dilay ES & Alas-Asin ES in Tanay, Rizal.*

Figure 25. *Actual pictures taken during site surveys in Cuyambay ES, Cayabu IS, San Andres ES in Tanay, Rizal.*

RuralSync: Providing Digital Content in Remote Communities Through Opportunistic Spectrum Access Project

The DOST-ASTI has responded to the President's directive to have an integrated program and implementation mechanism to ensure that TV frequencies are fully utilized by the government. Therefore, the Institute has initiated the exploration of maximizing the use of TV spectrum as a tool to share information, especially in areas where internet access is unavailable.

This project is only possible thru the country's adoption of the Japanese ISDB-T standard for digital TV broadcast services, allowing multiple programs in one channel. The data broadcasting, or datacasting – a key feature of the ISDB-T standard – is the addition or embedding of supplemental information or data along with the video and audio content. This project will use datacasting to transmit data such as learning materials, lectures, and other types of digital content.

For 2020, the DOST-ASTI team conducted initial RF and site surveys in six (6) barangays in Tanay, Rizal — potential sites for the pilot testing and deployment of RuralSync. Such activities for the project were put on hold due to the pandemic caused by COVID-19, thus, most of the activities planned for 2020 were rescheduled for 2021.

In 2021, the team plans to:

- Deploy the RuralSync prototype in the selected remote area.
- Implement the Development of Resilient Education Information Infrastructure for the New Normal (REIINN) Phase 1 Project with Electronics Industries Association of the Philippines Inc. (EIAPI). This will be in coordination with Department

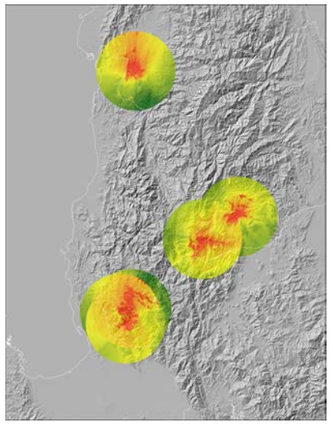


Figure 26. *Simulations for cellular towers (Smart telecom, 900mhz) in the Cordillera Autonomous Region (CAR) region.*

of Communications and Information Technology (DICT), the National Telecommunications Commission (NTC), Department of Education (DepEd), and the Philippine Space Agency (PhilSA).

Signal Assessment Using Geospatial Analysis Project

The Signal Assessment Using Geospatial Analysis Project (SAGAP) aims to generate propagation models and radio coverage maps using satellite data. The product will be useful to the Department of Information and Communications Technology (DICT), National Telecommunications Commission (NTC), and private communication and network companies. The results of the project can be used to assess the optimal positioning of communication towers for reference in improving connectivity in the country.

Figure 27. *SAGAP surveys cellular tower in Bonifacio Global City (BGC).*

In 2020, the team started the collection of field data to function as inputs for the fine tuning of the models used for the radio frequency propagation simulations. Areas with varying topographies and environments were surveyed to ensure that the models encapsulate the different effects of the environment on the behavior of signal propagation.

Figure 28. *SAGAP surveys cellular tower in San Juan Del Monte (SJDM), Bulacan.*

The areas surveyed include Quezon City, Manila, Caloocan, Rizal, Taguig, Makati, and Cavite.

Aside from field data, the team is also continuing the research on the use of satellite images to generate Digital Elevation Models (DEM) which will serve as input data for the simulations. The satellites used are KOMPSAT-3 (Optical) and KOMPSAT-5 (Synthetic Aperture Radar).

Initial communications with DICT were already conducted. Upon completion of research in 2021, the team will communicate the results with stakeholders for their perusal.

Completed R&D Programs and Projects

KATUNOG

Year 2: Activities and Milestones

The Philippine Indigenous Instrument Sounds Database, also known as KATUNOG (KAlipunan ng KaTUtubong TuNOG), is a collaborative project between the DOST-ASTI and the University of the Philippines Diliman - Electrical and Electronics Engineering Institute (UPD-EEEI). The team also worked with the College of Music and the College of Ethnomusicology as co-operating partners. The project aims to enhance the innovation and creative capacity of the local copyrights-based art industry and to preserve the Philippine sounds heritage in the 21st-century music landscape by making an indigenous sounds database available to the public. On its second year of development, ASTI received a total of PHP 2,635,123.20 funding from the DOST to augment the system's functionalities developed during its first year of implementation - these include mobile responsiveness, web analytics, web accessibility, and CMS-like features, among others.

The project implementation for Year 2, which ran from 01 September 2019 to 30 September 2020, underwent several activities like sprint planning, requirements elicitations, web application development, software testing, beta release, and final system deployment and turnover. Despite the pandemic, all activities turned out to be successful.

KATUNOG also expanded the current digital database by compiling audio recordings of Philippine indigenous music instruments since 2018. The database contains more than 100 instruments played in different pitches, dynamics and styles, including solo and ensemble performances. The online portal supports scalability and sustainability through an application programming interface (API) for other interested developers. Each instrument is supplemented with background information in text and multimedia. These include historical and cultural data, images, field sound recordings, and links to performances and related publications. The online database can be accessed through https://katunog.asti.dost.gov.ph

Figure 29. *Katunog Web Application – Map of instrument summary.*

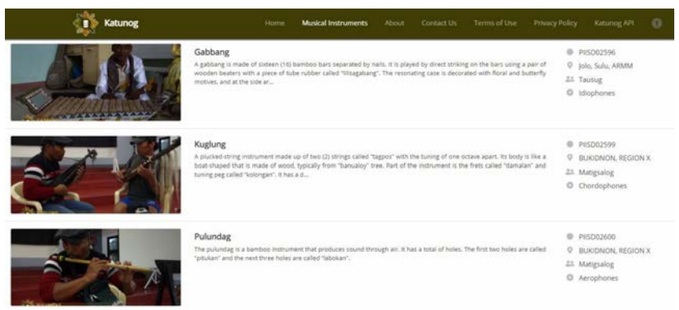


Figure 30. *Katunog Web Application – List of musical instruments page.*

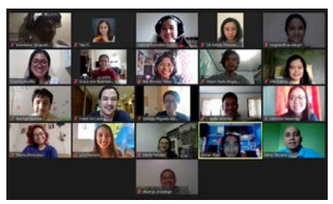


Figure 31. *Katunog Development Team from UP and DOST-ASTI during the Beta Release Activity.*

Figure 32. *The IDAS project development team from DOST-ITDI-ADMATEL and DOST-ASTI.*

Intelligent Data Analysis System Version 1.0

The Intelligent Data Analysis System (IDAS) Version 1.0 is a software-system developed as one of the implementation outputs of a collaborative project between the DOST's Industrial Technology Development Institute - Advanced Device and Materials Testing Laboratory (ITDI-ADMATEL) and DOST-ASTI. The system's main feature is the cluster analysis of spectra datasets generated from the application of time-of-flight secondary ion mass spectrometry (TOF-SIMS), Fourier-transform infrared spectroscopy (FTIR), and Gas Chromatography-Mass Spectrometry (GC-MS) to sample materials. This will aid the laboratory analysts of the ITDI-ADMATEL and the Philippine Drug Enforcement Agency (PDEA) in identifying other highly related sample materials for the purpose of further investigation.

Laboratory analysts of the ITDI-ADMATEL are now using the IDAS Version 1.0 in conducting multivariate analysis on spectra datasets of materials in coordination and collaboration with the Philippine Drug Enforcement Agency (PDEA). Methods implemented for the analysis of spectra datasets are composed of the K-Means clustering algorithm for cluster analysis, Principal Component Analysis for the reduction of the input spectra dataset's dimension, and the Least Squares method for the modeling of the kinetic stability of the materials. Results of these analyses aid the laboratory analysts of the ITDI-ADMATEL in inferring about the relationships between the analyzed materials.

The project produced intellectual properties such as copyrights which include the software system's computer program, technical documentation, and user manuals. Trademarks are also in the process of filing and registration. End-user and administrator trainings were also conducted prior to the conclusion of the project. The IDAS Version 1.0 was officially launched in April 2021.

Development of Thermal Scanner

The onset of the COVID-19 pandemic marked the unprecedented need for a contactless thermal scanner to measure human temperature never exceeding 37.3°C, among other precautions set by Inter-Agency Task Force on Emerging Infectious Diseases.

Figure 33. *The system uses Principal Component Analysis to reduce the input dataset's dimension. Users may choose to view the dataset in either any of the two or three derived components for visual inspection.*

Figure 34. *The activation energy value of the sample is calculated in the system using well-known equations for kinetic stability modeling.*

Figure 35. *DOST-ASTI developed Thermal Scanner.*

For a reliable and affordable thermal scanner, the DOST-ASTI embarked on developing the technology locally from 16 March 2020 until 31 December 2020. In the almost 10-month implementation of the project, the team has developed a total of 16 wireless thermal scanners using an android application for a contactless usage.

To ensure safety of use of the developed thermal scanners before distribution to the public, the team sought assistance from National Metrology Division of the DOST - Industry Technology Development Institute (ITDI) for the calibration of the sensor; and the DOST - Electronics Product Development Center (EPDC) to conduct EMC (electromagnetic compliance) and ESD (Electrostatic Discharge).

Optimization of the Operational Capabilities of Hydromet Sensors in Line with International Standards (WMO Standards) for Effective Weather, Flood Warning (CBFEWS) and Application to Research

The Optimization Project spearheaded by the DOST - Philippine Atmospheric, Geophysical and Astronomical Services Administration (DOST-PAGASA), in partnership with the DOST-ASTI and DOST Regional Offices, aims to retool, reposition, and augment existing weather and warning stations, equipment, and related weather facilities in accordance with the international standards for a better service of weather monitoring, advisory,

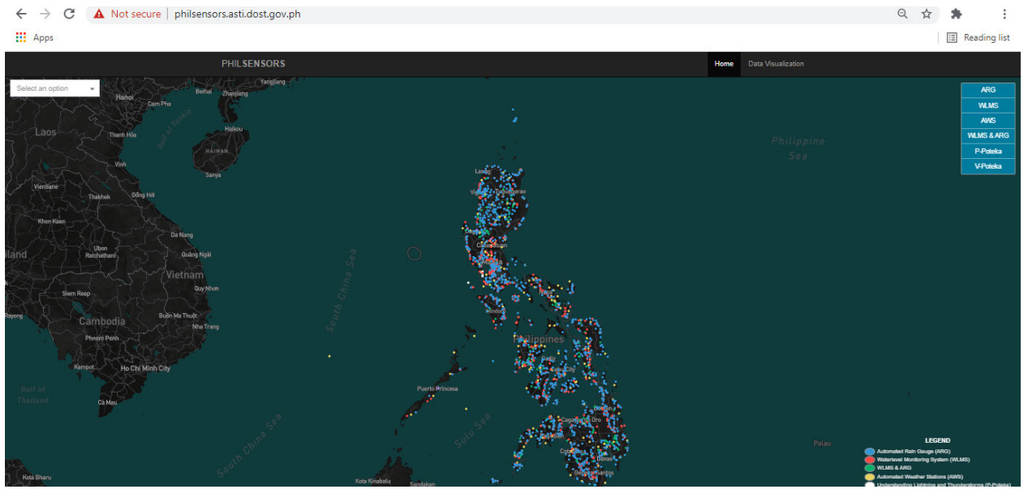


Figure 36. *Philsensors website visualizing the distribution of the deployed and installed Hydromet and warning stations nationwide.*

Figure 37. *Information and Education Campaign (IEC) in Region IX conducted in Dapitan City, Zamboanga del Norte.*

Figure 38. *Trainers responding to the questions from the participants during the IEC in Region IX (from left to right) Mr. Orendain (DOST-PAGASA), Mr. Flores (DOST-PAGASA), Ms. Yabut (DOST-ASTI), and Ms. Cureg (DOST-ASTI).*

and research application.

Although the project has a three-year implementation period, DOST-ASTI's part is only until the first 24 months from 01 June 2018 until 30 June 2020. In this duration, the project team has accomplished the following:

- Conducted six (6) maintenance and troubleshooting trainings of hydromet and warning stations for PAGASA regular and project staff.
- Conducted meetings for the IEC and Flood Drill activities in Regions I, IX, and X.
- Participated in the IEC and Flood Drill activities in Laoag, Ilocos Norte and Pinan, Zamboaga del Norte.
- Coordinated with PAGASA for the webinar planning on the features and uses of warning stations as replacement for IEC.
- Participated in the IEC webinar for Region X.
- Improved and maintained the visualization website based on suggestions and comments from the DEWS Technical Panel.
- Submitted the necessary documents to proceed with the transfer of ownership of the stations and the wireless communication plans to PAGASA,
- Conducted series of meeting and in-house training with PAGASA staff for the visualization website and

Figure 39. *In-house training of DOST-PAGASA staff for warning stations.*

Figure 40. *In-house training of DOST-PAGASA staff for arQ troubleshooting and maintenance.*

Figure 41. *The technology leverages on Artificial Intelligence (AI) using computer vision to detect social distancing violations (6 feet) in a specific area.*

Figure 42. *The system identifies people movements to detect social distancing violations through the application and integration of a distance checking algorithm.*

monitoring wireless communication subscriptions.

The completion of the project deliverables is not without challenges. On the course of its implementation, the team had a delay in delivering such outputs due to the delay of budget release, staff tasks turnover, website downtime, and the COVID-19 pandemic, among others.

AI-based detection of Social Distancing Violation from CCTVs

Coined as the Smart Distancing App, the effort leverages on Artificial Intelligence (AI) using computer vision to detect social distancing violations (6 feet) in a specific area. From real-time video streams, the system identifies people movements to detect social distancing violations through the application and integration of a distance checking algorithm.

This technology has been tested with input video streams from CCTV systems, as well as built-in and external webcams.

To test the system's viability, researchers have deployed the technology at a system-level integration on DOST-ASTI's CCTV infrastructure, running 24/7 as a monitoring operation. The distancing app was tested on the CCTV Feed of the building's reception area and was monitored by guards on duty with active participation of the researchers and personnel present during the test.

The project seeks to initially detect social distancing violations with a threshold of 6 feet distance between two individuals. During curfew hours, the app will detect human presence and will methodologically flag it as a violation. The app will run on dedicated workstations disconnected to the internet to prevent security and privacy issues.

The Smart Distancing App is a scalable solution that can be applied to different structures with existing monitoring systems (e.g., CCTV) with the intent of strengthening health protocols, especially during this pandemic.

Researchers envision the project to be adapted by Local Government Units (LGUs) down to its barangay-level. This way, barangays with existing CCTV infrastructure can use the system to be installed as detector on major chokepoints and congregation points. Barangay tanods (guards) will be tasked to monitor the CCTV feed. The project can also be deployed on building establishments, schools, and offices.

PastTrack

A Contact Tracing Application

Contact tracing is described as a method of identifying individuals who have been exposed to the virus. By identifying known carriers and persons who have encountered them, and subsequently identifying those who have their respective contacts, these individuals can be monitored, quarantined, and treated to reduce infections in the population.

The Computer Software Division (CSD) of the DOST-ASTI developed PastTrack, a contact tracing application, to help the government's effort in fighting and preventing the spread of COVID-19. The application is designed

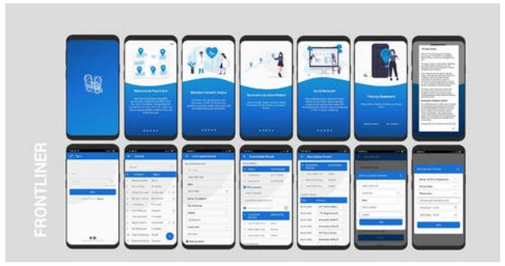


Figure 43. *The patient's interface to generate 2-week cellular location historical data for contact tracing.*

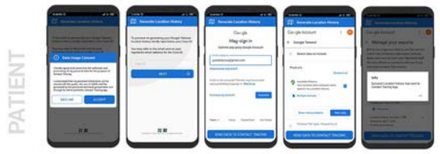


Figure 44. *The frontliner's interface to monitor patient's status, manage information, and generate location history of patients.*

for our Local Government Units' (LGU) City Epidemiology and Surveillance Units (CESU), as well as District and Public Health Offices tasked to conduct data entry of suspect, probable, and confirmed patients.

The application utilizes Google Takeout Service to obtain the patient's location history. This application can assist LGUs in ensuring that the data for analysis is complete, clean, and updated. The collected data can be further used to generate insights and to build networks using cellular location historical data, uploaded to the WebGIS and Dashboard component of the system, for efficient contact tracing and COVID-19 status monitoring.

This initiative was spearheaded by the SGV & Co. in collaboration with CSD, as well as the Research and Development Division (RDD) and Solutions and Services Engineering Division (SSED) of the DOST-ASTI. PastTrack outputs include the mobile application which serves as the interface for front liners or health workers and patients for health information and 2-week location historical data collection; and the Operation Center Data Synchronization (OpCen DataSync) Application to synchronize raw patient's data from LGU's operation center to the DOST-ASTI's server.

The project was implemented from March 2020 to May 2020. The PastTrack mobile application was deployed to the Davao De Oro Provincial Government in May 2020. Project presentations and end-user trainings conducted in April 2020 were attended by officials and personnel from the Davao De Oro Provincial Government, DOST Region XI, and representatives from health offices and LGUs of Davao de Oro prior the deployment.

Figure 45. *Onboarding meeting of EPDC as one of laboratory members of OneLab Network last 21 February 2020.*

Figure 46. *Group photo of OneLab ITDI technical team headed by ITDI Director Dr. Annabelle V. Briones (6th from the right) and EPDC personnel headed by Engr. Victor Gruet (3rd from the left).*

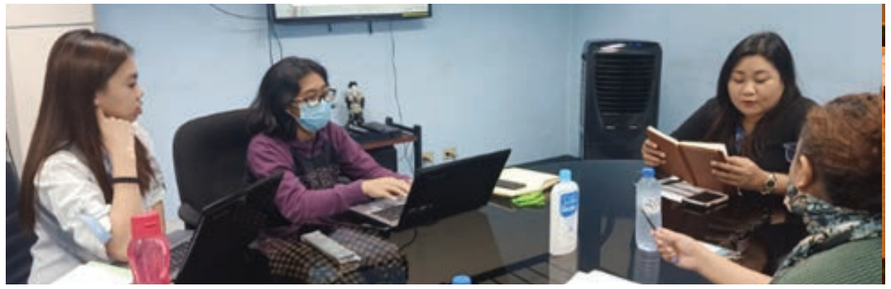
Enhancing OneLab for Global Competitiveness

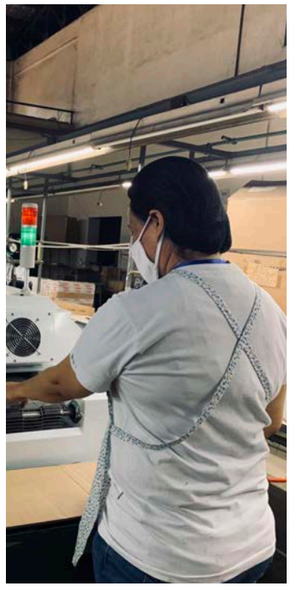
The project *"Enhancing OneLab for Global Competitiveness (OneLab)"* is an innovation in the service delivery of laboratories in the DOST system. The platform integrates DOST's regional offices and research institutes' laboratories into a network that provides easy access to testing and calibration services for the manufacturing and other industries, entrepreneurs, and the public in general.

As of 2019, the OneLab network also includes selected non-DOST laboratories all over the country and the world. The networking of laboratories through the OneLab project enables DOST Regional Standards and Testing Laboratories (RSTLs) and Research and Development Institutes (RDIs) to coordinate laboratory transactions with other DOST laboratories that can do tests required by clients. Such set-up facilitates the testing requirements of clients who no longer have to travel from one testing center or laboratory to another to complete their testing requirements.

Because of the pandemic, this year's activities of the project primarily involved remote assistance to continuously provide support to the OneLab Unified Laboratory Information Management System (ULIMS) and Referral Module developers on matters regarding technical issues and maintenance of system accounts in the DOST-ASTI's Computing and Archiving Research Environment (CoARE) cloud facility.

The project team also facilitated the onboarding of Electronics Product Development Center (EPDC) as one of the member laboratories of the OneLab network. With this, the services being offered by EPDC will now be available online via the OneLab portal.





Technology Transfer Program

Technology Licensing and Commercialization

Guided by its mission to "Foster Innovation in the Field of Information and Communications Technology and Microelectronics by Bridging the Gap Between Technology and People using Technology Transfer Mechanisms", the DOST-ASTI's Technology Licensing Office (TLO) is tasked to smoothly transition the Research and Development outputs of the agency from securing its intellectual property (IP) assets up to successfully transferring them for the purposes of either Public Good, Extension Service, or Com mercialization.
Among its specific activities are:

- Managing the agency's IP Portfolio.
- Technology promotion/diffusion of technologies which are ready for commercialization.
- Licensing by means of commercialization or for public good.
- Protection of the researcher's IP Rights from the beginning of the project proposal or its conceptualization, up to the technology transfer activities.
- Preparation of the documents and other requirements for the Fairness Opinion Board (FOB) evaluation.
- Undertaking the necessary steps such as legal coordination, executing partnerships, and preparing reports in order to successfully update various DOST agencies, government offices, academe, and the industry.
- Establish and maintain linkages with stakeholders from various sectors and end-users.

In 2020, DOST-ASTI released a total of 61 licenses through End-User Licensing Agreements (EULAs) for public good purposes. Majority of the end-users were from the academe (53%), while the greatest number of data licensed to be used were weather data (56%).

[TLO – 20210427 – 0001.jpg. EULA distribution according to sector.]

[TLO – 20210427 – 0002.jpg. EULA distribution according to type of data.]

Table 1. Detailed Distribution of Licenses Released in 2020

Technology	Academe or R&D	Government with Industry a Partnership	Government	Independent and Autonomous Non-government	Private	TOTAL
Weather Data from Meteorological Data Acquisition Stations for Information Dissemination (MASID)	19	2	6	1	0	28
Satellite Images and Satellite Data from Philippine Earth Data Resource and Observation1 (PEDRO) Center	17	1	6	0	0	24

Derived Earth Observation Maps using Artificial Intelligence from the Remote Sensing and Data Science (DATOS) project	2	0	0	0	0	2
Lightning and Weather Data from Understanding Lightning and Thunderstorms (ULAT)	5	0	2	0	0	7
TOTAL	43	3	14	1	0	61

To date, there are three (3) private companies that have undergone the FOB evaluation from December 2019 to April 2020 to adopt DOST-ASTI's technologies for commercialization. As a result, three (3) Fairness Opinion Reports and three (3) Written Recommendations were issued by the board and the DOST Secretary respectively.

More so, negotiations with two (2) new prospective licensees were held which were formalized during the virtual stakeholders' meeting in 2020. One (1) licensee is interested to license MASID's Tsunami Early Warning System's Alerting Device, while the other is interested to license the AI4Mapping by the DATOS project, which was pushed for immediate commercialization transition under the HIRANG program of the DOST-Technology Application and Promotions Institute (TAPI).

Complementing the technology transfer, DOST-ASTI-TLO has assisted researchers in filing a total of four (4) copyrights, six (6) trademarks, four (4) patents and two (2) industrial designs in 2020 despite the quarantine period due to the COVID-19 pandemic. The patents filed, and the Freedom to Operate reports of five (5) technologies were generated through the funding assistance of DOST-TAPI. The improved IP portfolio in comparison from the past years, which was 300% increase in the number of patents filed, opened more opportunities for the agency to transfer its research and development outputs to its intended stakeholders by means of commercialization in the succeeding years.

[TLO – 20210427 – 0003.jpg. Number of ASTI IP Filings from 2010 - 2020: Despite 2020 being a tough year due to threat of the COVID-19 pandemic, ASTI was still able to protect its Intellectual Properties and even saw an increase in its patent protections filed; from one patent last 2019 to four patent filings in 2020.]

Technical Services

Philippine Earth Data Resource and Observation (PEDRO) Center

The Philippine Earth Data Resource and Observation (PEDRO) Center was established in 2016 to support space assets of the Philippines and receive earth observation data from various satellites. It operates two ground receiving stations (GRS) in the country: the DOST-ASTI-GRS in the DOST-ASTI Building in Quezon City, Metro Manila; and the Davao GRS in Davao City. Through these facilities, the PEDRO Center supports our space endeavors by directly tasking and receiving satellite data on-demand.

The PEDRO Center provides satellite images to various government agencies and academic institutions for various applications such as post-disaster damage assessment and emergency response management, monitoring of government projects, and maritime surveillance. Other applications include environmental assessment, urban-change detection, and other similar activities.

To continue its mandate of providing satellite images to concerned government agencies and academic institutions, the PEDRO Center distributed satellite images to different agencies including Office of Civil Defense, Philippine Army, Maritime Research Information Center, PHIVOLCS, as well as local government units and researchers from the academe.

The PEDRO Center also continued to monitor the country throughout the year. The satellite data distributed aided disaster management during weather disturbances and disasters throughout 2020 and monitored select areas during the enhanced community quarantine (ECQ) and general community quarantine (GCQ) considering the COVID-19 pandemic.

[PEDRO - 20210330 - 0001. This KOMPSAT-3 satellite image taken over Alcala and Amulung, Cagayan Valley in 11 November 2020 shows severe flooding caused by Typhoon Ulysses]

[PEDRO - 20210330 - 0002. These Sentinel-2B images comparing Taal Volcano before and after its phreatic eruption in 12 January 2020. The image shows Taal before the eruption (December 24, 2019) and after the eruption (January 13, 2020).]

Aside from operating in-house satellites Diwata-2 and Maya-1, the PEDRO Center was also subscribed to commercial satellites in 2020. For the year, the PEDRO Center was subscribed to Dove Satellite, KOMPSAT-3, KOMPSAT-3a, KOMPSAT-5, and WorldView-3 to help in providing satellite data to concerned government agencies and the academe. For 2020, the PEDRO Center catered to a total of 4035 image downloads (5.10 terabytes of data) in the PEDRO Portal, the platform used by PEDRO Center to distribute images.

In total, the PEDRO Portal already catered to 8877 image downloads (10.289 terabytes of data) ever since its inception in 2018.

On 16 October 2020, the PEDRO Center received a special award from Philippine Navy's Naval Intelligence and Security Force (NISF) for contributing to maritime efforts by providing satellite images since 2018.

The Computing and Archiving Research Environment (COARE)

In 2020, the Computing and Archiving Research Environment (COARE) continuously upheld its strong commitment to provide free and high-quality services to its beneficiaries. During the year, the users of the COARE facility made 791 service requests for High-Performance Computing, 360 service requests for Science Cloud, and 324 service requests for Data Archiving. These amounted to a total of 1,475 services rendered for the beneficiaries of the facility. Notably, there is a steady increase in the combined number of these service requests during each quarter of 2020. For 2020, 29% of the users of the COARE facility came from the government, 51.5% were from the academe, 5.5% were from non-government organizations, 3.5% were from local government units, and 10.5% came from private institutions.

One the most remarkable accomplishments of COARE during 2020 is its prioritized allocation of resources to institutions and researchers who are studying the nature of COVID-19. The facility contributed to the Department of Health's (DOH) Feasibility Analysis of Syndromic Surveillance using Spatio-Temporal Epidemiological Modeler (FASSSTER); the COVID-19 Operations Center Monitoring Dashboard and Data Platform of the DOST-ASTI and SyCip Gorres Velayo & Company (SGV); the CovCheck application of UP Cebu; the COVID research analyses of the UP Philippine Genome Center (UP-PGC); and the Advancing Antivirals thru Combined Computational Design and Emerging

Omics to Leverage Repurposed and Natural Drugs for SARS-CoV-2 Therapeutics (ACCELER8) project of UP schools and De La Salle University, among others.

In May to September 2020, the COARE team achieved a milestone by completing the launch of its new, next generation supercomputer Saliksik—which boosted the technical capacity of the COARE facility to a total of 1,744 cores (3,488 threads). To improve the overall user support of COARE, the team also made significant developments in its Information Technology Service Management (ITSM) model, through the deployment of an internal team wiki (Subwiki), and the addition of features for the COARE Wiki and the COARE iTop, platforms that are instrumental in using the COARE facility.

Existing policies, such as the Service Level Agreement, Acceptable Use Policy, and the Data Policy, which all aim to strengthen the proper usage and rules regarding COARE, have been updated to cater new provisions for the said services and for the changes that the pandemic brought.

Lastly, researchers for COARE were able to publish the paper, Correcting Job Walltime in a Resource-Constrained Environment, in the Asian Conference on Supercomputing Frontiers 2020.

Table 2. Total Number of Service Requests (Applications, Renewals, Tickets) for 2020

	Q1	Q2	Q3	Q4	TOTAL
HPC Service	167	235	190	199	791
Science Cloud Service	77	90	91	102	360
Data Archiving Service	35	30	108	151	324
TOTAL	279	355	389	452	1,475

Philippine Research, Education and Government Information Network (PREGINET)

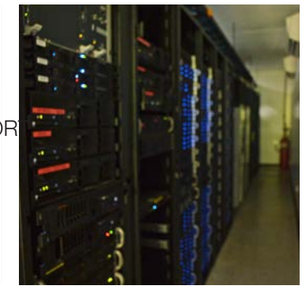
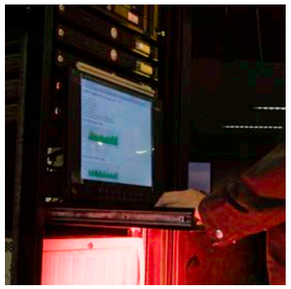
PREGINET, the country's research and education network (NREN), centers on providing high-speed network connectivity to facilitate research collaborations and development among academic, research institutions, and all Philippine government agencies. It also plays a critical role in the day-to-day operations of its partnered agencies especially amid the COVID-19 pandemic. The notable services of PREGINET include:

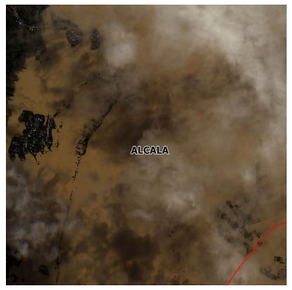
- Provision of infrastructure to strengthen the National Research Network (includes State Universities and Colleges (SUCs), Government, and R&D agencies), specifically in fostering interconnectivity with different SUCs to improve the academic network through collaboration with the PRIME Project.
- Provision of infrastructure for DOST-ASTI's services such as COARE and PEDRO.
- Linking the country to international RENs such as Asia-Pacific Advanced Network (APAN), Asia Pacific Network Information Cenre (APNIC), Asi@Connect - the successor of Trans-Eurasia Information Network 4 (TEIN 4) - and Singapore Advanced Research & Education Network (SingAREN).
- Participation in content sharing with School-on-the-Internet Asia (SOI-Asia) and the Asian Internet Interconnection Initiatives (AI3) Project, both Japanese-led research initiatives spearheaded by Keio University.
- Provision of technical support in conducting 74 telemedicine activities through its active partnership with Kyushu University in connecting local hospitals to Asian counterparts.
- Operation of the Philippine Open Internet Exchange (PhOpenIX), the only neutral internet exchange in the Philippines that enables Internet traffic exchange in a free-market environment among local Internet and data service providers.

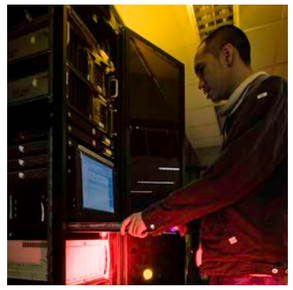
After 20 years, .gov.ph finds a new home in DICT

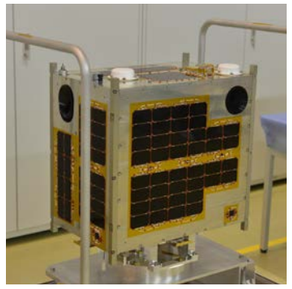
On 05 November 2018, the DOST-ASTI and the Department of Information and Communications Technology (DICT) signed a Memorandum of Agreement to officially transfer the responsibilities of the .gov.ph domain administration to the latter. The service has finally been turned over to DICT on 03 February 2020,two decades since DOST-ASTI spearheaded the .gov.ph domain administration.

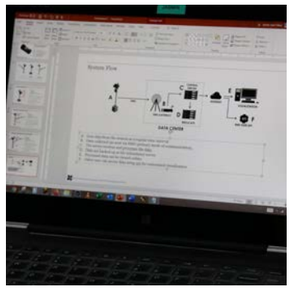
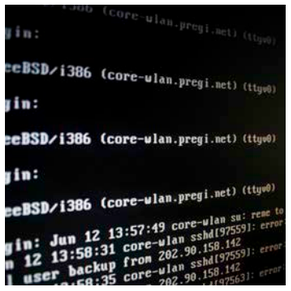
The transfer of one of the DOST-ASTI's earliest services as an institution was deemed beneficial to improve the delivery of the service. Prior to the transfer, DOST-ASTI handled the registration, modification, and deactivation of subdomains under the .gov.ph domain. On the other hand, the DOST Information and Communications Technology Office (DOST-ICTO), now DICT or Department of Information and Communications Technology, has been hosting government websites since 2013 in accordance with the Administrative Order 39. This means that clients who wished to setup a website needed to coordinate with the two government agencies just to put up a website. The process was inefficient and could sometimes lead to confusion when troubleshooting domain and hosting concerns. With the new setup, DICT centrally handles all responsibilities pertaining to the .gov.ph administration and hosting of government websites.

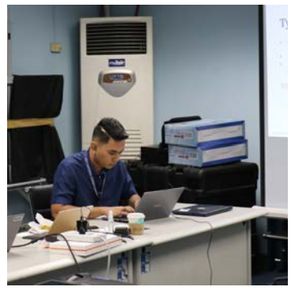



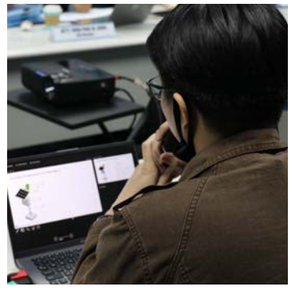










Foreign and Local Linkages

Foreign Linkages

DOST-ASTI Space Projects

Hokkaido University

Hokkaido University is a university in Japan geared as a global center for education and research. In a vision aimed to launch 50 to 100 microsatellites into space through a consortium of different Asian nations, Japanese universities like Hokkaido University and Tohoku University collaborated with the Development of Philippine Scientific Earth Observation Microsatellite (PHL Microsat) to build microsatellite Diwata-1 (launched in 2016) and the succeeding satellite Diwata-2 (launched in 2018), with a focus on the payload of the satellite.

Tohoku University

Tohoku University, established in 1907, is one of the leading universities in Japan. Tohoku University and Hokkaido University collaborated with the University of the Philippines - Diliman in a project called Development of Philippine Scientific Earth Observation Microsatellite (PHL Microsat) which primarily aims to build microsatellites for the country. Tohoku University helped in the building of Diwata-1 and Diwata-2's satellite bus system, while sharing technical know-how with Filipino engineers.

Kyushu University

The Kyushu Institute of Technology pioneered the Joint Global Multi-Nation Birds Satellite Project or the BIRDS Project, a multidisciplinary satellite project that gathers non-spacefaring nations to design and develop their cube satellites. The Philippines first joined the project for the second installment, the BIRDS-2 project, which launched the very first cube satellite of the country, Maya-1. Throughout 2020, the country through students from different universities worked on the second cube satellite Maya-2 under the BIRDS-4 Project. Maya-2 will be launched into orbit in March 2021.

Japan Aerospace Exploration Agency (JAXA)

The Japan Aerospace Exploration Agency (JAXA) was born through the merger of three institutions: the Institute of Space and Astronautical Science (ISAS); the National Aerospace Laboratory of Japan (NAL); and the National Space Development Agency of Japan (NASDA). It was designated as a core performance agency to support the Japanese government's overall aerospace development and utilization. JAXA, therefore, can conduct integrated operations from basic research and development to utilization.

JAXA played a vital role in the success of the current Philippine satellites. The agency's HII-A rocket launched Diwata-2 into space last October 29, 2018. JAXA's testing facilities were also used during the development phase of Diwata-1 and Diwata-2 and helped in the launch requirements and activities for the transport and release of the satellites Diwata-1, Maya-1, and Maya-2 from the International Space Station.

- Use of Testing Facilities for D1 and D2.
- Interface to the launch requirements and activities for the transport and release of the satellites from the ISS (D1, Maya-1, Maya-2).
- Use of their H2A launch D2 to space.

Korea Aerospace Research Institute (KARI)

The Korea Aerospace Research Institute (KARI) is the aeronautics and space agency of South Korea. Established in 1989, KARI functions as the center for its country's endeavors in the development of technology for satellites, aircraft, and space launch vehicles as well as the research and development and dissemination of information on aerospace technology.

DOST-ASTI's partnership started in 2016 during the establishment of PEDRO-GRS. The first antenna system, in partnership with CGC (Comtech), was set up on the rooftop of the ASTI office through the partnership with KARI and was able to receive the first image from South Korea's multispectral satellite: Kompsat-3.

Geo-Informatics and Space Technology Development Agency (GISTDA)

The Geo-Informatics and Space Technology Development Agency or GISTDA, is the space agency and space research organization of Thailand. Established in 2000, GISTDA assumed all the responsibilities over the country's space technology and geo-informatics applications started by the various remote sensing programs started in the country decades

prior.

GISTDA has been a close partner since 2016, wherein engineers and project managers from DOST-ASTI were invited to their headquarters for knowledge sharing during the time wherein DOST-ASTI was just starting their plans to set up the country's first earth observation ground receiving station. In 2019, two researchers participated in a remote sensing applications workshop hosted by the Thai space agency.

Surrey Satellite Technology (SSTL)

The Surrey Satellite Technology Ltd., (SSTL) is a United Kingdom-based company established in 1985 specializing in different space services such as earth observation satellites. Starting out in University of Surrey in the 1970s, the SSTL became a commercial enterprise that provides its customers with satellite data and other services for space and from space.

In August 2019, the DOST-ASTI signed an agreement with SSTL to share the data tasking and acquisition of the NovaSAR-1 satellite. The synthetic aperture radar (SAR) satellite with an automatic identification system (AIS) will provide all-weather and all-day imaging of the country that will help improve terrestrial and maritime monitoring.

Philippine Research, Education, and Government Information Network (PREGINET)

Ministry of Agriculture, Forestry and Fisheries Information Network (MAFFIN), Japan

ASTI has been the direct termination point of the Japan-PH MAFFIN/APAN link in the Philippines since 2004. This link enabled numerous research and education endeavors from access to crucial data used in typhoon tracking and e-learning initiatives. It also made it possible for the Philippines to participate in international events as well as establish access grid facilities.

Keio University, Japan

ASTI and Keio University started its partnership in 1998 when the Institute became involved in the Asian Internet Interconnection Initiatives (AI3). AI3 is a research consortium focused on developing progressive Internet technologies such as IPv6, multimedia communication methods, and modern internet applications. It also facilitates in the development of knowledge-based information infrastructure in Asian region. Moreover, the Agency participates in the said University's School-on-the-Internet (SOI) Asia Project which seeks to contribute to the development of the higher education in Asian countries.

Asia-Pacific Advanced Network (APAN)

APAN is a non-profit international research and education network (REN) aimed at facilitating and coordinating development, deployment, operation, and technology transfer of advanced network-based applications and services in the R&E community within the Asia Pacific Region. As a primary member of APAN since 2003, ASTI regularly participates and collaborates in APAN-related activities that focus on discussions and case studies in the areas of network technology, natural resources, and technology applications which can be useful to the advancement of PREGINET's applications, management, and operation.

Asia Pacific Network Information Center (APNIC)

APNIC is an open, membership-based, and non-profit organization in-charge among the five (5) Regional Internet Registries (RIRs), with the fair distribution and responsible management of IP addresses and related courses that are critical for the stable and reliable operation of the global Internet. The 1992 established organization unceasingly collaborates with ASTI since 2009, maintaining a good bond between two agencies by participating in various trainings and seminars, establishing of Internet exchange, exchanging of information, infrastructure development and business in Asia Pacific Region, promoting education and training delivery, and other initiatives on Internet Operation and management.

Asi@Connect

Asi@Connect is the successor of TEIN 4, which was created to provide a dedicated high-capacity internet connectivity for research and education communities across the Asian community. It supports data-intensive and time-critical applications between collaborating institutions and research on climate change, disaster management, typhoon warning signals, and telemedicine, among others.

Hokkaido University, Japan

In cooperation with Hokkaido University and other entities, along with Japan International Cooperation Agency (JICA) – the primary Japanese government agency responsible for technical cooperation component of Japan's bilateral ODA (Official Development Assistance) program – led to the implementation of a project entitled Understanding Lightning and Thunderstorms (ULAT) Project. The said five-year research collaborative project aims to observe the country's weather behaviors through studying torrential rainfall and thunderstorm occurrences as parameters to eventually enable short-term forecasts. As of July 2019, 25 P-POTEKA and four (4) V-POTEKA units were deployed/installed. In addition, continuous installations and deployments were being conducted to achieve the deliverables of the said project.

Singapore Advanced Research and Education Network

SingAREN is a non-profit organization that operates the national research and education network (NREN) of Singapore and therefore maintains connectivity among members of the academe, government, and research institutes in Singapore and with international RENs, promoting research and development, and adoption of advanced internet technologies. SingAREN has been known to aid research projects on cancer genomics and precision medicine, through worldwide collaborative projects like the GenomeAsia 100k Project and The Cancer Genome Atlas (TCGA). As a step in advancing the field of Bioinformatics, DOST-ASTI forged a Collaboration and Service Agreement with SingAREN to establish a direct link between the two NRENs in 2019.

National Institute of Information and Communications Technology, Tokyo, Japan

In collaboration with the National Institute of Information and Communications Technology (NICT), the mirror site in the Philippines for the Himawari-8 website was deployed in DOST-ASTI in 2016 to improve users' experience of the PREGINET stakeholders (e.g., PAGASA). Implementing mirror systems reduces network traffic and increases speed access to the real-time website. Data shown from the Himawari-8 website are from the Japanese weather satellites operated by the Japan Meteorological Agency (JMA). As one of the most disaster-prone countries in South-East Asia, the Philippines benefits from the images and data it accessed from the Himawari-8 website in strengthening its disaster management practices.

Local Linkages

DOST-ASTI Space Projects

Civil Aviation Authority of the Philippines (CAAP)

The Civil Aviation Authority of the Philippines (CAAP) is mandated to establish and prescribe rules and regulations for the inspection and registration of all aircraft owned and operated in the Philippines and all air facilities; further establish and enforce rules and regulations of laws governing air transportation; and operate and maintain national airports, air navigation, and other similar facilities in compliance to International Civil Aviation Organization (ICAO).

The Davao GRS was established in partnership with CAAP. CAAP – Davao International Airport met all the requirements for the operation of the Davao GRS. With this, CAAP allowed DOST-ASTI to build the Davao-GRS in their Remote Transmitter Site. CAAP also aids in the security of the DGRS, while it is in their premises.

Department of Science & Technology – Region XI

The DOST-XI is mandated to provide central direction, leadership, and coordination of scientific and technological efforts to ensure that the results are geared and utilized in areas of maximum and social economic benefits of the people especially in the region.

DOST XI collaborates with the DOST-ASTI in maintaining and operating the Davao-GRS. They report issues related to Davao-GRS to DOST-ASTI and accommodate site visits as approved by ASTI.

Department of Information and Communications Technology (DICT)

The DICT is mandated to be the primary policy, planning, coordinating, implementing, and administrative entity of the Executive Branch of the government that will plan, develop, and promote the national ICT development agenda.

The DICT provides the connectivity of Davao GRS, the PEDRO Center's second ground receiving station.

Philippine Research, Education, and Government Information Network (PREGINET)

Government Agencies

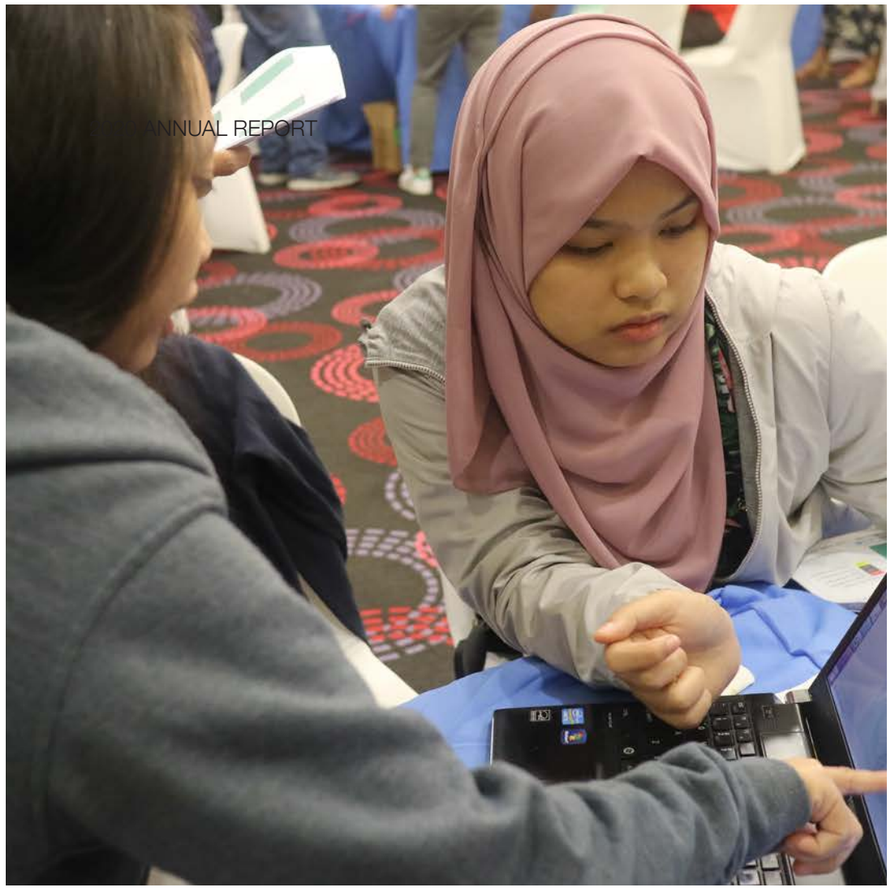
- DOST Central Office
- DOST- PHIVOLCS
- DOST-PAGASA (Head Office)
- DOST-PAGASA (Baguio)
- DOST-PAGASA (Cebu)
- DOST-PCIEERD
- DOST-PCAARRD
- DOST-Science Education Institute
- DOST-Science and Technology Information Institute
- DOST-Technology Application and Promotion Institute
- DOST-National Academy of Science and Technology
- DOST-National Research Council of the Philippines
- DOST-NCR
- DOST-CALABARZON
- DOST-MIMAROPA
- Department of Health
- House of Representatives
- Department of Information and Communications Technology
- PEZA Open Technology Business Indicator
- MMDA
- NAMRIA –Taguig
- NAMRIA—Binondo
- Court of Appeals (CA)-Manila
- CA-Cebu
- CA-Cagayan de Oro

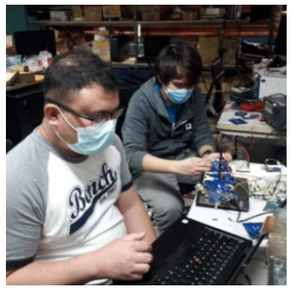
Academic Institutions

- University of the Philippines (UP) Los Banos
- UP Los Banos Open University
- UP Iloilo
- UP Miagao
- UP Cebu
- UP Tacloban
- UP Mindanao
- UP School of Health Sciences (SHS)-Aurora
- UP SHS-Palo, Leyte
- UP SHS-Koronadal, Cotabato
- Philippine Science High School – Diliman
- Ateneo de Manila University
- De La Salle University
- Central Luzon State University
- Mindanao State University-Iligan Institute of Technology
- Mariano Marcos State University-Batac
- Batangas State University
- Pangasinan State University

Research and Development Institutions

- DOST-ASTI
- DOST-PNRI
- DOST-FNRI
- DOST-ITDI
- DOST-PTRI
- International Rice Research Institute
- Forest Products Research and Development Institute





Organizational Learning and Development

Process Development

The DOST-ASTI continues its pursuit in achieving set objectives and commitment for continual improvement. For 2020, the agency was able to fully implement the ISO 9001:2015 standards and received a confirmation its certification valid until 2022 November. Surveillance Audit was conducted remotely by the TUV SUD PSB.

Moreover, the team also was able to produce 19 Risk Registers compared 11 last 2019.

Regular follow-ups, coordination with project personnel, and possible issuance of nonconformities from internal or external auditor were key factors for the increase.

There was also a consistent rise in the submission of Customer Satisfaction Survey. Aside from the existing survey for external services, other internal services had enrolled their surveys to better monitor their performance (e.g. Procurement Section, KM Unit). There was also clarification with regards to the type of service offered by the ERP Procurement System – from being a product in 2018, to service in 2019. Teams who had also conducted events were also able to distribute survey forms adding in the spike of customer satisfaction reports submission. The agency continued to achieve a ***"Very Satisfactory"*** ratings for its activities conducted.

Figure 47. *DOST-ASTI ISO 9001:2015 Certificate valid until November 2022.*

The team was also heavily involved in the first-ever audit conducted by the DOST-Internal Audit Service (IAS) since 2020 November.

Knowledge Development

The Knowledge Management Unit was able to continue to serve the DOST – ASTI staff in their need for documented information, assistance in the improvement of their activities, and assistance in their compliance of documentary requirements amidst the declaration of COVID-19 Pandemic. The Unit had focused its available resources on activities that could be catered remotely.

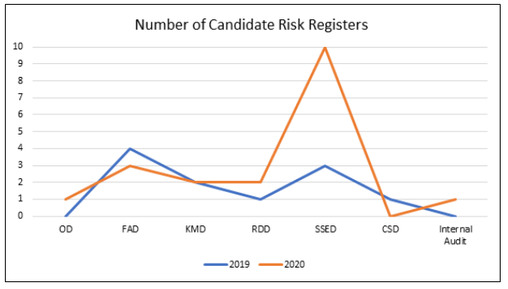


Figure 48. *Number of candidate Risk Registers produced by each division.*

Figure 49. *Customer Satisfaction Survey submission comparison for 2019 and 2020.*

Knowledge Base

The Unit continued to ensure that contents of the website are up to date. For 2020, the unit updated 291 pages on the site. Most of these pages were more from updates from Project Documentations Page, revisions in ISO 9001:2015 – related documents, as well as those pages that need to be revisited from time to time.

February had a significant increase of updates since the Unit had pursued the creation and update of the Project Documentation Page.

After Action Reviews

The Unit continued to extend its service by regularly conducting After-Action Reviews online. For 2021, the Unit aims to extend its services to more projects.

For 2020, the KM Unit accommodated the Human Resources Information System (HRIS) After Action Reviews online as well as IDAS Project.

Other Activities

The KM Unit was still able to accommodate other activities such as post-Evaluation (seven sessions, mostly for DATOS project), Knowledge Sharing Activities (five sessions), assistance to the conduct of the second training course for Records Management, and drafting of the Public Service Continuity Plan (PSCP), among others. Other planned activities halted due to the pandemic would be carried over in 2021.

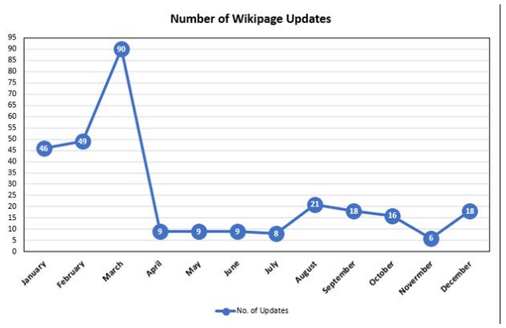


Figure 50. *Number of Wikpages updates for 2020.*

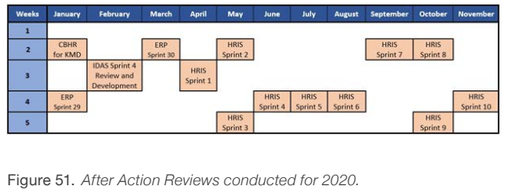
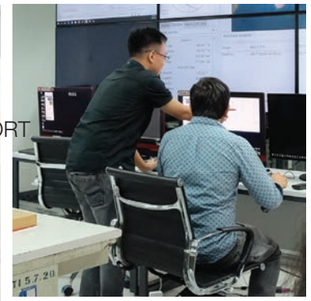
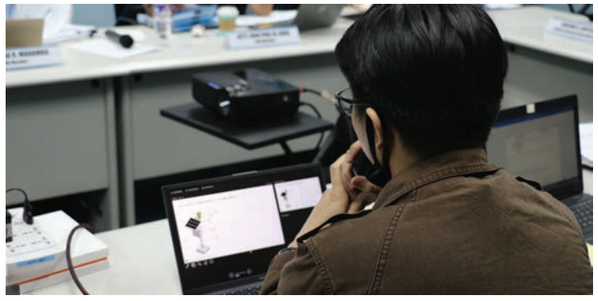


Figure 51. *After Action Reviews conducted for 2020.*





Financial, Human Resource and Procurement Management

Financial Performance

In CY 2020, the institute generated a total funding of P326,826,419.25, of which 95.17% or P311,026,144.63 was utilized as of 31 December 2020. Breakdown as follows:

	Allotment	Obligations	Balances	% Utilization
A. Current Year's Allotment				
1. Regular Appropriations	323,681,585.16	307,881,449.73	15,800,135.43	95.12%
2. Automatic Appropriations (RLIP)	1,131,416.13	1,131,416.13	-	100.00%
3. Special Purpose Fund				
a. PGF	85,020.00	85,020.00	-	100.00%
b. MPBF	1,714,000.00	1,714,000.00	-	
Sub-Total, Current	326,612,021.29	310,811,885.86	15,800,135.43	95.16%
B. Prior Year's Allotment				
1. Regular Appropriations	214,397.96	214,258.77	139.19	99.94%
Sub-Total, Continuing	214,397.96	214,258.77	139.19	
GRAND TOTAL	**326,826,419.25**	**311,026,144.63**	**15,800,274.62**	**95.17%**

Out of the total allotments utilized by the institute, 87% was used as funding support for the technical activities of DOST-ASTI, while the remaining 13% represents the expenses incurred for the General and Administrative Support Services (GASS). Breakdown below:

Activity Type	Obligations	% Share
GASS	41,079,704.91	13%
Technical	269,946,439.72	87%
TOTAL	**311,026,144.63**	**100%**

Below is a 5-year comparative summary of annual appropriations for the Institute:

Fiscal Year	PS	MOOE	CO	TOTAL
2017	48,345,000.00	468,853,000.00	81,170,000.00	598,368,000.00
2018	51,738,000.00	454,391,000.00	43,000,000.00	549,129,000.00
2019	61,138,000.00	357,804,000.00	-	418,942,000.00
2020	61,839,000.00	269,110,000.00	8,878,000.00	339,827,000.00
2021	68,741,000.00	375,240,000.00	69,048,000.00	513,029,000.00

*RLIP included

Human Resources Management

Recruitment

As part of the strategic plans of the Human Resource Management Section to recruit competent technical personnel, the team joined the UP-Career Assistance Program for Engineering Students (UP CAPES) job fair on 04 - 05 February 2020. It is known as one of the biggest engineering collegiate career fair where the agency was able to source a pool of talents and students who are interested to be part of the institute.

Learning & Development

The Human Resource Management Section plays a vital role in ensuring that employees continuously acquire and learn the necessary skills amidst the pandemic in 2020. Hence, the Section disseminated several training opportunities to the employees through e-mails and implemented the use of the Learning Application Form to monitor the attendance of the employees at webinars, online trainings, and/or workshops offered during the community quarantine. Employees have, indeed, experienced greater opportunities to attend webinars during the quarantine because most of the trainings were conducted through online platforms and are free of charge.

Foreign Scholarships

Mar Francis D. De Guzman, Science Research Specialist II of the Solutions and Services Engineering Division, graduated with a degree in Bachelor of Science in Electronics and Communications Engineering (BS ECE) and Master of Science in Electrical Engineering (MSEE) which were both taken at the University of the Philippines, Diliman. As one of the proactive researchers who aims to establish a collaborative and quality researchers in the institute, Mr. De Guzman pursued a doctoral degree in Electrical Engineering at the Aalto University, Finland thru the scholarship offered by the Department of Science and Technology – Science Education Institute (DOST-SEI) to focus on his research and coursework, as well as to further hone his knowledge in the field of R&D.

International Publication Awards

Researchers of the DOST-ASTI were encouraged to publish their research papers in the Web Science/ Clarivate Analytics or Scopus indexed journals. The following papers were recognized and awarded by the DOST – NAST during the virtual flag ceremony held on 01 December 2020:

3) "Alternative Backhaul link for Community Cellular Network in Rural Coastal Areas" by Mar Francis D. De Guzman, Calvin Artemies G. Hilario, Ronel Vincent P. Vistal, Ian C. Mosquera, Julius M. Judan, and Joel Joseph S. Marciano, Jr. 2019 IEEE Global Humanitarian Technology Conference 9033087: 1-6, 2019.
4) "Development of Software Defined Radio-based Satellite Telemetry and Telecommand System in Virtual Instrumentation Environment" by Calvin Artemies G. Hilario, Mar Francis D. De Guzman, Alvin E. Retamar, and Joel Joseph S. Marciano, Jr. 2019 6th International Conference on Space Science and Communication 8905946: 201-206, 2019.
5) "Distributed AC Optimal Power Flow with Resilience from Communication Failure in MMG Systems" by Fredmar N. Asarias, and Michael Angelo A. Pedrasa 2019 3rd International Conference on Smart Grid and Smart Cities 00011: 211-216, 2019.
6) "Quantitative Assessment of TV White Space in the Western Philippine Nautical Highway" by Rizza T. Loquias, Calvin Artemies G. Hilario, Mar Francis D. De Guzman, and Joel Joseph S. Marciano, Jr. 2019 IEEE International Symposium on Dynamic Spectrum Access Networks 8935798: 330-337, 2019.
7) "Multivariate Time Series Imaging for Short-Term Precipitation Forecasting Using Convolutional Neural Networks" by Sun Arthur A. Ojeda, Geoffrey A. Solano, and Elmer C. Peramo International Conference on Artificial Intelligence in Information and Communication 48513: 33-38, 2020.
8) "Analog Domain Cancellation in Hybrid Self-Interference Cancellers for In-Band Full-Duplex Radios" by Ramon Vann Cleff Raro, Genedyn Gems S. Mendoza, and Mar Francis D. De Guzman 2019 IEEE Asia-Pacific Microwave Conference 9038235: 646-648, 2019.
9) "Polarization Reconfigurable Antenna Using Fractals and DGS for Wi-Fi Applications" by Gian Carlo Duque, Mar Francis De Guzman, and Steven Matthew Cheng 2019 International Symposium on Antennas and Propagation (ISAP) 1-4, 2019.
10) "Polarization Reconfigurable Two-Layer Stacked Patch Antenna Design for Wi-Fi Applications" by Cashmere Joy Ramos, Steven Matthew Cheng, and Mar Francis De Guzman 2019 IEEE Asia-Pacific Microwave Conference (APMC) 9038261: 1563-1565, 2019.
11) "The Philippine Earth Data Resource and Observation Center- An Enabler in Disaster Risk Reduction and Management" by Nash Frederic M. Prado, Julius M. Judan, Lianne Maxine A. Tabanggay, Rocell Nino B. Vicente, Harold Bryan S. Paler, and Alvin E. Retamar 40th Asian Conference on Remote Sensing: Progress of Remote Sensing Technology for Smart Future 3: 2135-2145, 2019.

Events

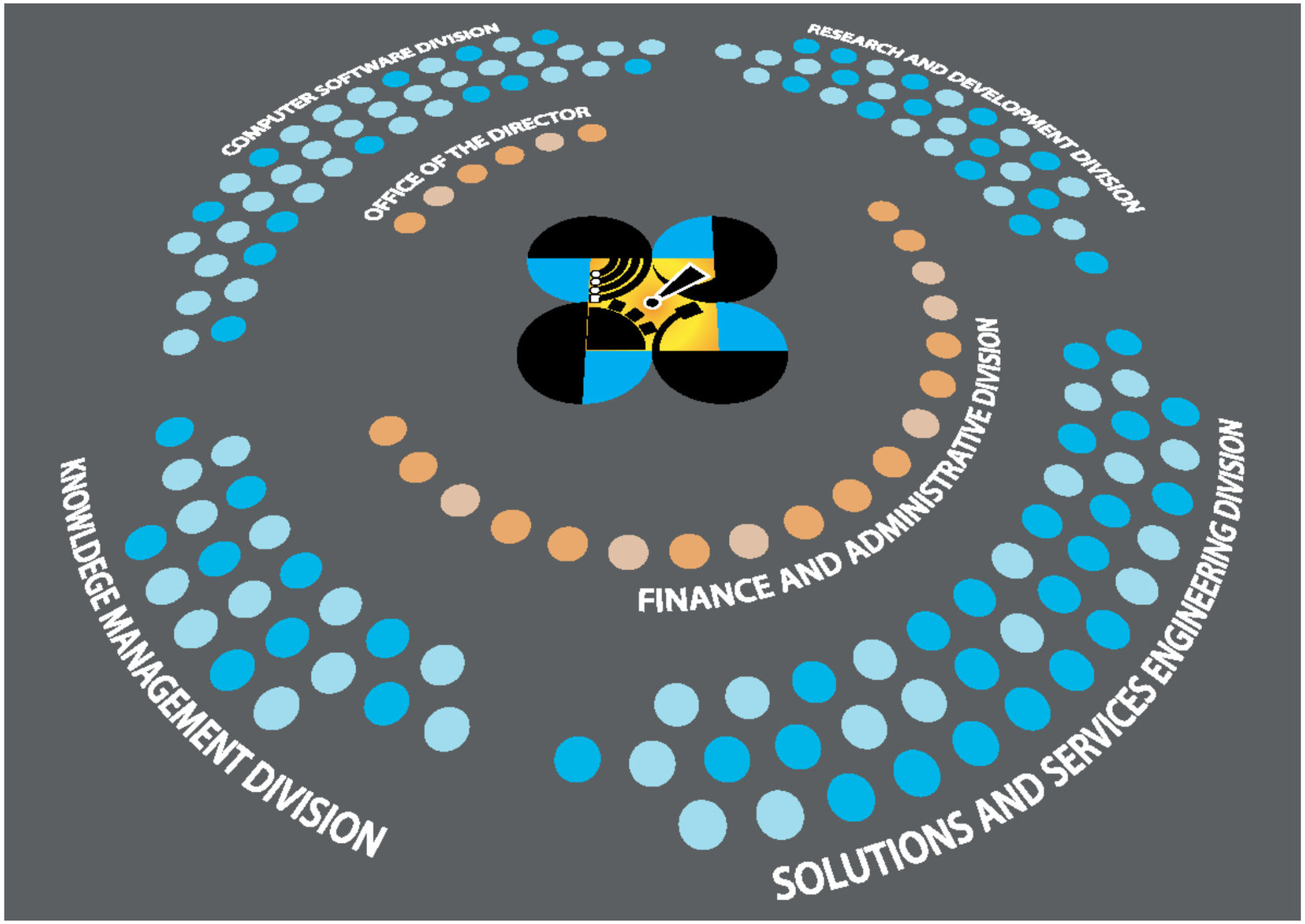
On 18 December 2020, the Human Resource Management Section has successfully managed to organize the very first virtual DOST-ASTI Christmas Party which was conducted via the Zoom platform. Employees participated by joining the online games, raffles, and presentations.

Organizational Structure

The DOST-ASTI is composed of six (6) divisions, namely:

1) Office of the Director (OD).
2) Finance and Administrative Division (FAD).
3) Research and Development Division (RDD).
4) Solutions and Services Engineering Division (SSED).
5) Computer Software Division (CSD).
6) Knowledge Management Division (KMD).

Together, the divisions work to implement the mission, vision, and corporate objective of the DOST-ASTI.



Office of the Director

The Office of the Director (OD) oversees the overall welfare of the agency as it sets the agency's strategic direction, formulates internal policies, and ensures implementation to attain goals and objectives. It is also responsible for the planning and monitoring of research programs/projects, setting of performance indicators and evaluation of agency performance, development and maintenance of agency competencies and capabilities, technology licensing, and corporate communication.

Finance and Administrative Division

The Finance and Administrative Division (FAD) provides support and necessary services for the welfare of the agency and staff. It advises and assists the other divisions on budgetary, financial, procurement, and management matters.

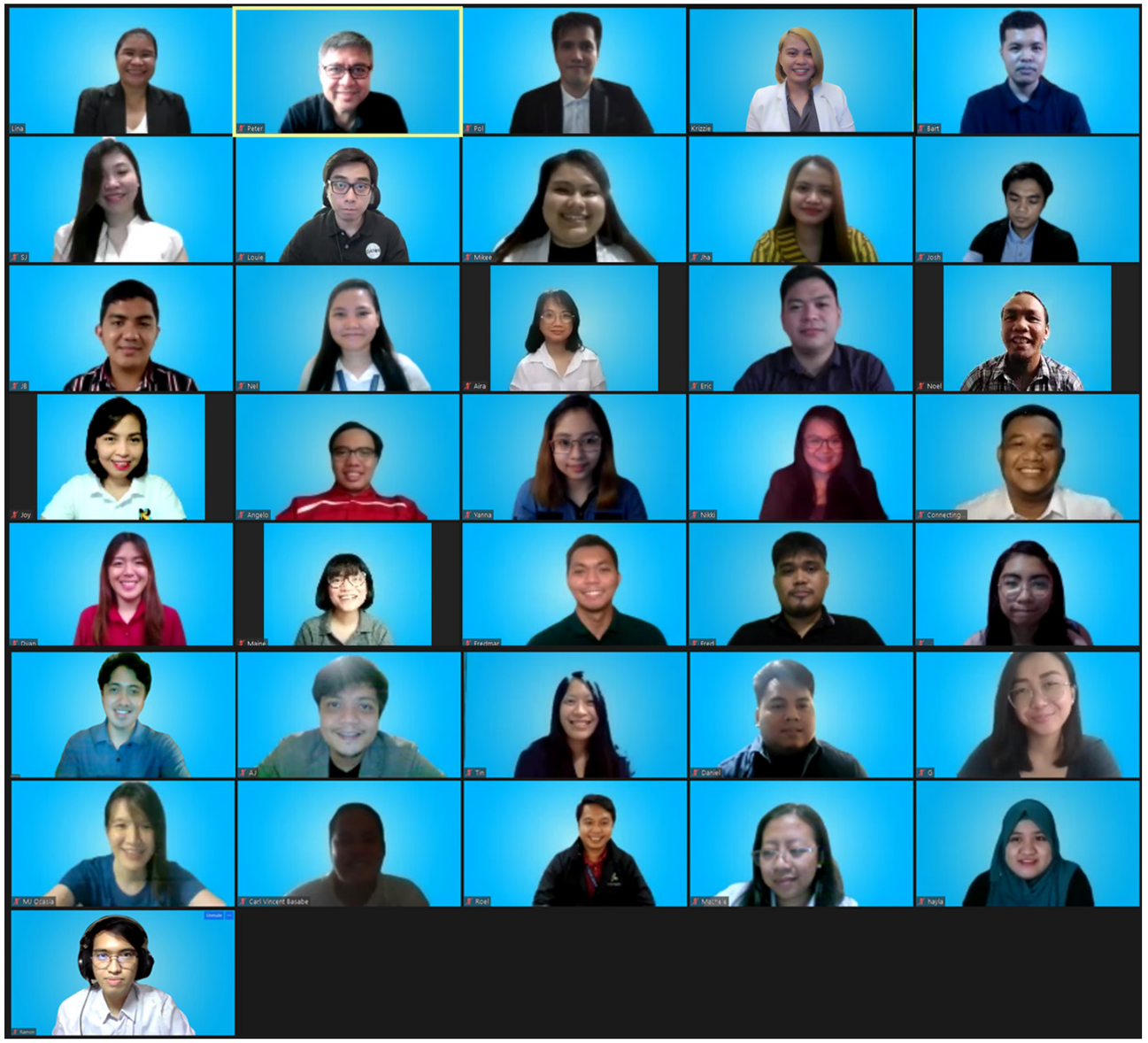
Knowledge Management Division

The Knowledge Management Division (KMD) was created for the purpose of increasing and better leveraging the DOST-ASTI's available intellectual capital and enabling the agency to continuously improve its performance. The division is composed of the Knowledge Management (KM) Unit, and the Management Information Systems (MIS) Unit.

The KM Unit carries out the following functions:

- Source, mine, synthesize, and package knowledge for internal and external use.
- Leverage knowledge to improve organizational performance of the Agency.
- Proactively share knowledge for development impact.
- Leverage KM as an integrating component for selected technology solutions.

The MIS Unit develops and maintains the Agency's information systems. It leverages KM to design and develop information systems to improve the Agency's internal and external processes. It also provides support in maintaining the agency's computing resources.



Research and Development Division

The Research and Development Division (RDD) conducts strategic R&D in ICT and Electronics taking direction from the national S&T Plan, as well as, ICT and Electronics industry development roadmaps. The Division is divided into three (3) sections, namely:

- Network Research, which implements R&D projects in the fields of HPC and advanced computing.
- Computing Research Section, that focuses on projects involving AI-based technologies and applications, smart cities, etc.
- Microelectronics Research Section, which prioritizes research activities that would establish the design foundation and know-how, which are vital to the country's entry into the local and global market for integrated circuits and embedded products and solutions.

Solutions and Services Engineering Division

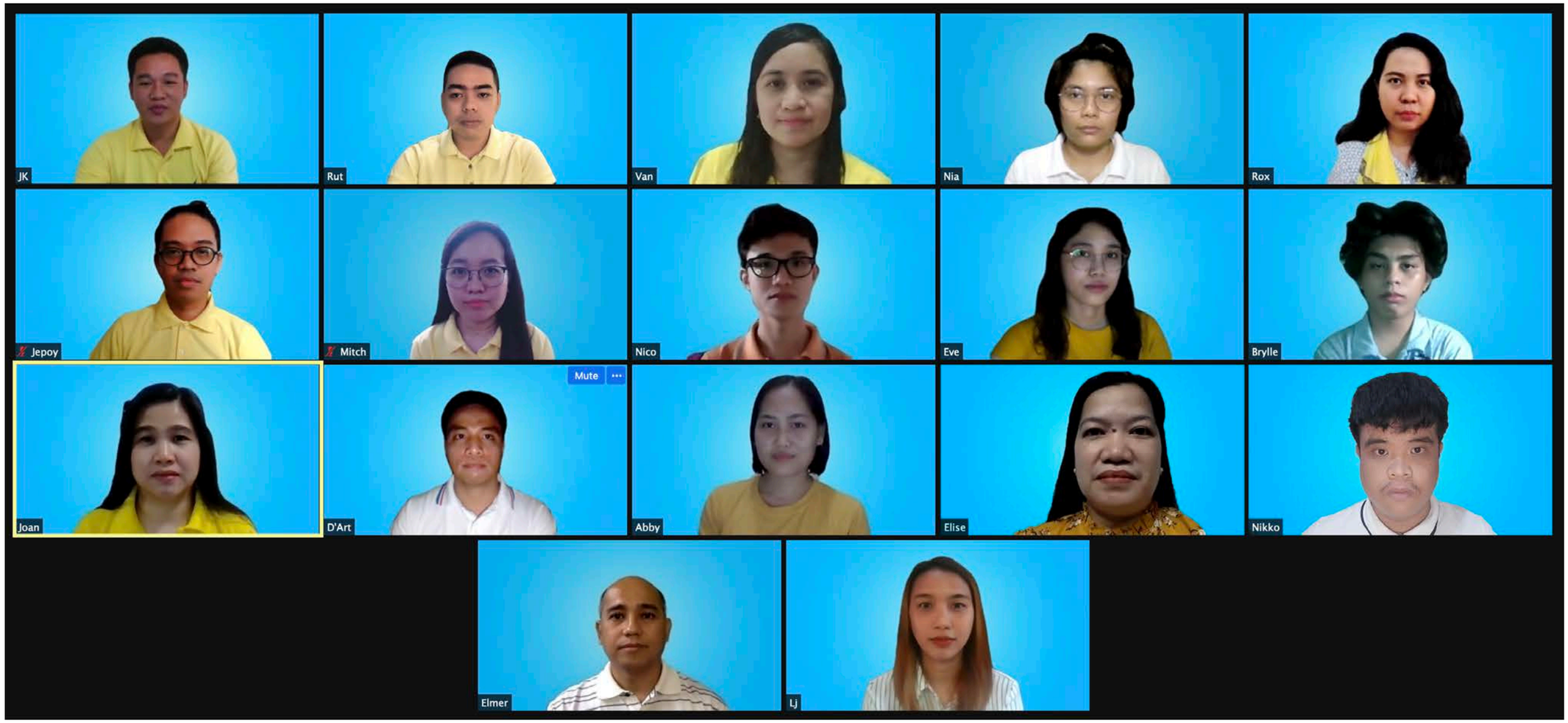
The Solutions and Services Engineering Division (SSED) develops ICT- and electronics-based solutions for various entities from both the public and private sectors. SSED provides holistic, end-to-end solutions that cover design, development, implementation, deployment, project management, and support services. Likewise, the division facilitates operations and research through the provision of infrastructure, facilities, data, information, and other services.

SSED has collaborative and multidisciplinary teams that work together to deliver complete solutions.

The Embedded Systems Group implements and deploys electronic-based solutions that incorporate microcontrollers, communication, mechanical design, visualization, backend development, and support services.

The Network Operations Group operates and maintains the National Research and Education Network (NREN) and Philippine Open IX. The team supports and enables the projects and activities of the academe, research organizations, and government agencies through the provision of connectivity and network services such as VoIP, IPv6, and videoconferencing, among others.

The Space Systems Group operates the country's ground receiving station to receive data from earth observation satellites. It is also involved in the development of space technologies such as microsatellites and cube satellites. Moreover, it contributes to the development of the space technology ecosystem in the country.



Computer Software Division

The Computer Software Division (CSD) focuses on R&D initiatives using innovative software technologies, solutions, and quality systems and applications. It forges and strengthens partnerships with the academe, government, and industry by providing effective software solutions, design, and development consultancies. It aims to add value to clients' needs and strives to consistently work on improving customer satisfaction.

The research teams are organized as software engineering, and research and development. The software engineering team oversees the development and implementation of software solutions (system and application). It is composed of four sub-teams: business analysis, software development, software quality assurance, and systems security and administration.

The R&D team is tasked to conduct basic and applied researches for different problem domains (law, health, education, transportation, industry, agriculture, etc.) by applying state-of-the-art and emerging software technology.

Annex

Major Final Outputs

Technologies Transferred (Commercialized / Diffused)

Table 3. *Technologies Transferred thru EULAs, Commercialization, Diffusion*

Name of Technology	Mode of Transfer	Beneficiaries
Raw Satellite Images from Philippine Earth Data Resource and Observation Center (PEDRO)	EULA (End-User Licensing Agreement)	UP Diliman (Faculty and Students), Quezon City, NCR
	EULA	MDRRMO, Iloilo, Region VI
	EULA	Provincial Government of Cagayan, Cagayan Province, Region II
	EULA	Cagayan Provincial Assessor's Office
	EULA	UP Resilience Institute, Quezon City, NCR
	EULA	Bicol University of Engineering, Region V
	EULA	UPLB, Laguna, Region IV-A
	EULA	DPWH, NCR ARUP, NCR
	EULA	Mines and Geosciences Bureau, Quezon City, NCR
	EULA	Bureau of Soils and Water Management, Quezon City, NCR
	EULA	Visayas State University , Leyte, Region VII
	EULA	University of the Philippines Diliman DGE / COE Division, Quezon City, NCR
	EULA	UPD (TCAGP), Quezon City, NCR
Weather data from Meteorological data Acquisition Stations for Information Dissemination (MASID) i.e., Automated Rain Gauge (ARG), Water Level Monitoring Station (WLMS), Tandem Station, Automated Weather Station (AWS), Agrometeorological Station (Agromet), Disaster Early Warning System (DEWS) (Flood Alerting Station), Tsunami Early Warning System (TEWS) Alerting Station)	EULA	UP IESM, Quezon City, NCR

Name of Technology	Mode of Transfer	Beneficiaries
	EULA	Philippine Coconut Authority, Quezon City, NCR
	EULA	UP Diliman, Quezon City, NCR
	EULA	Mapua University, Manila, NCR
	EULA	Philippine Red Cross, Mandaluyong City, NCR
	EULA	DOST PAGASA Tagum-Libuganon, Davao, Region XI
	EULA	UP Diliman -NGSE / TCAGP, Quezon City, NCR
	EULA	Central Research Institute of Electric Power Industry / Hokkaido University
	EULA	University of San Carlos, Cebu, Region VII
	EULA	UPLB, Laguna, Region IV-A
	EULA	Bulacan State University, Bulacan, Region III
	EULA	DA-RFO 5, Bicol, Region V
	EULA	MOST-BARMM, Cotabato City, ARMM
	EULA	Ascott Inc. / Baguio LGU, CAR
	EULA	Ramboll / Baguio LGU, CAR
Derived Earth Observation Maps using Artificial Intelligence from the Remote Sensing and Data Science (DATOS) project	EULA	UP Diliman, Quezon City, NCR
Lightning and Weather Data from Understanding Lightning and Thunderstorms (ULAT) P-POTEKA (Plate Stations) and V-POTEKA (VLF) stations	EULA	UP Diliman IESM, Quezon City, NCR
	EULA	De La Salle Araneta University, Malabon City, NCR
	EULA	Muntinlupa DRRMO, Muntinlupa City, NCR
	EULA	UP Diliman, Quezon City, NCR
	EULA	DOST-PAGASA, Quezon City, NCR

Name of Technology	Mode of Transfer	Beneficiaries
Remote Sensing and Data Science: DATOS Help Desk (DATOS Project)	Technology / Project Demo and Presentation	Participants of the *"UND (Deeper Understanding of Natural Disaster – Instrumental for Disaster Mitigation) Project Meeting and Workshop"*. 15-17 January 2020. Malaysia.
	Technology / Project Demo and Presentation	Participants of the *"IP Valuation Write shop / Training for DOST Research and Development Institutes"*. 16-17 January 2020. Taguig City, NCR.
	Technology / Project Demo and Presentation	Participants of the EU Conference on *"Copernicus - a strategic partner for Earth Observation and sustainable development"*. 06 February 2020. Makati City, NCR.
	Technology / Project Demo and Presentation	Participants of the *"PDRRM Meeting cum Presentation of DRR technologies which can be implemented in the province"*. 11 February 2020. Cavite, Region IV-A.
	Technology / Project Demo and Presentation	DOST Regional Office VI, Iloilo City PDRRMC Capiz, Roxas City, Region VI
	Technology / Project Demo and Presentation	Participants of *"Nerdfest Online: Communicate! Communicate! (Science Communicators'* Roundtable Discussion". Nerd Rage Ph.
	Technology / Project Demo and Presentation	Participants of Vibal online session entitled *"New Now: AI and Satellite Imagery: Scientific Research during COVID-19"*. Vibal Group.
	Technology / Project Demo and Presentation	Participants of *"Planet Labs Stakeholders"* Meeting (Webinar): How Space Technology Applications Contributed to Combatting COVID-19 Pandemic. Planet Labs.

Name of Technology	Mode of Transfer	Beneficiaries
	Technology / Project Demo and Presentation	Participants of the DOST-ASTI Technology Transfer Webinar for Enterprise Resource Planning (ERP) System, Kooha Application, Gul.ai Technology, AI4Mapping, MASID Weather Stations, and the PhilSensors website. 27 November 2020. Quezon City, NCR.
DATOS Applications: *"AI and Satellite Images for DRR in the New Normal"*"" AI4Mapping: DATOS-generated DRRM products and applications	Technology Presentation	Participants of 'iFWD PH Program: Teknokonsultasyon para sa Makabagong Bayani. Organized by DOST NCR.
DATOS: AI4Mapping: DATOS-generated DRRM products and applications	Technology Presentation	Participants of *"DOST - CALABARZON"*s National Science and Technology Week (NSTW) Celebration: Webinar on Appreciation of DRRM Maps".
DATOS: Use Cases and applications *"Mapping Applications of Space Technologies for Disaster Risk Reduction and Agriculture"*	Technology / Project Demo and Presentation	Philippine Space Agency (PhilSA); Space Technology and Applications Mastery, Innovation and Advancement (STAMINA4Space) Program for *"Our Place in Space: Press Briefing"*. Quezon City, NCR.
DATOS: AI4Mapping	Technology / Project Demo and Presentation	Philippine-American Academy of Science and Engineering (PAASE) for 2020 Annual PAASE Meeting and Symposium: *"Outreach to Philippine Regions"*.
DATOS: Sugarcane Plantation Mapping Using Dynamic Time Warping from Multi-temporal Sentinel 1-A Radar Images (Annals)	Technology / Project Demo and Presentation	International Society for Photogrammetry and Remote Sensing (ISPRS) for *"XXIV ISPRS Congress"*.
DATOS: Near-real-time Flood Detection from Multi-temporal Sentinel Radar Images using Artificial Intelligence (Archives)	Technology / Project Demo and Presentation	International Society for Photogrammetry and Remote Sensing (ISPRS) for *"XXIV ISPRS Congress"*.
DATOS: AI4Mapping: The Future of Earth Observation and Satellite Maps Generation	Technology / Project Demo and Presentation	DOST Provincial S&T Center Rizal for *"Forum on DOST RDI"*s Developed Technologies".
PastTrack	Technology / Project Demo and Presentation	LGUs, Davao de Oro DOST Region XI DHOs, Davao de Oro DOST Region XI MHOs, Davao de Oro DOST Region XI
Electronics Product Development Center	Technology / Project Demo and Presentation	Participants of the DOST-ASTI Webinar. 26 November2020.
ASTI Enterprise Resource Planning System	Technology / Project Demo and Presentation	PhilSA staff participants. Quezon City, NCR.
RuralSync	Technology / Project Demo and Presentation to prospective stakeholders	DOST, Taguig City, NCR UP Diliman, Quezon City, NCR Alexan Corporation, Manila, NCR
COARE DATOS	Technology / Project Demo and Presentation	Participants of the *"Workshop for the LandSAGE2 Project"*. 06-07 February 2020. Thailand.
Flood Early Warning Stations	Technology / Project Demo and Presentation	IEC participants. 11 March 2020. Zamboanga del Norte.
AESS prototype	Technology demo / testing	ASTIEA Officers and Members. Quezon City, NCR.
ERP KOOHA Gul.ai AI4Mapping (DATOS) Meteorological Data Acquisition Stations for Information Dissemination (MASID)	Technology / Project Demo and Presentation	Participants of DOST RO IV-A's (PSTC Rizal) *"Online Forum on DOST RDI"*S Developed Technologies: Featuring Technologies from DOST-ASTI". 18 September 2020. Quezon City, NCR.

S&T Service Beneficiaries

Table 4. *Technical services rendered includes PEDRO, COARE, DATOS, EPDC, Weather Data Requests*

	Technical Services Rendered	Client / Beneficiaries
DATOS	AI generated flood situation maps from 25 December 2019 Sentinel-1 capture for areas affected by Typhoon Usman; Sentinel-1 satellite image for corresponding area	DOST Regional Office VI, Iloilo City PDRRMC Capiz, Roxas City
	Animated gif of the ashfall / cloud movement brought by Taal's recent activity; zip folder containing files, which can be used for Taal Volcano monitoring	DOST Central Office, Taguig City, NCR DOST-PHIVOLCS, Quezon City, NCR Office of the Civil Defense, Quezon City, NCR
	KML and shapefiles of the structures within the permanent danger zone (Volcano Island) as of April 2019 Kompsat 3	DOST Central Office, Taguig City, NCR DOST- PHIVOLCS, Quezon City, NCR Office of Civil Defense, Quezon City, NCR DOST Regional Office IV-A, Laguna
	Generated InSAR products (Taal interferogram) using Sentinel 1 captures dated January 9 and 16	DOST-PCIEERD, Taguig City, NCR
	Processed Sentinel-3 images for the potential ashfall extent in the Calabarzon Region	DA-FPOPD (Field Programs Operational Planning Division, NCR PhilRice-PRISM, Nueva Ecija Sugar Regulatory Administration, Pampanga DOST IV-A, Laguna
	Sparse unwrapped interferogram from ALOS-2 generated for Taal Volcano Monitoring; PSInSAR data from Sentinel 1A and 1B	DOST-PHIVOLCS, Quezon City, NCR
	Raw and processed Planet, Kompsat 3, and Sentinel 3 images for Taal Volcano monitoring	DOST-PHIVOLCS, Quezon City, NCR
	Raw and processed Landsat8 images for Taal Volcano monitoring	DOST-PHIVOLCS, Quezon City, NCR Office of the Civil Defense, Quezon City, NCR Department of Agriculture, Quezon City, NCR Sugar Regulatory Administration, Quezon City, NCR DOST Region IV-A, Laguna
	EO data and DATOS-generated flood products	Vienna University of Technology / University of the Philippines Diliman (student / faculty), Quezon City, NCR
	Mapped built-up areas near Kanlaon crater (generated from Planetscope images at 3m resolution taken on 17 and 24 June 2020)	DOST Central Office, Taguig City, NCR DOST- PHIVOLCS, Quezon City, NCR Office of the Civil Defense, Quezon City, NCR PhilRice-PRISM DA-FPOPD
	Screenshots of the detected built-up areas within the 4km permanent danger zone of Mount Kanlaon	DOST-PHIVOLCS, Quezon City, NCR
	Generated interferogram from ALOS2 SAR images for Masbate earthquake	DOST-PHIVOLCS, Quezon City, NCR
PREGINET (Philippine Research Education, and Government Information Network)	Provision of internet connectivity	TNP (Telemedicine Network of the Philippines) TEMDEC (Telemedicine Development Center of Asia) UP Manila / National Taiwan University DICT
	Provision of videoconferencing / streaming services in the conduct of webinars / Telemed activities	TNP PALES PSA HSP PAFP (Philippine Academy of Family Physicians) PAPRAS NTC Philippine College of Surgeons PCARI PSGS Phil. Association of HPB Surgeons PhilSPEN *Asi@Connect* / TEIN PTA PCS

	Technical Services Rendered	Client / Beneficiaries
	Maintenance / Troubleshooting of network links / Network configurations	Physically connected PREGINET partner-institutions from the government and academic sectors (list available upon request). Other government and academic institutions: PAGASA-Mactan PAGASA-Baguio DICT-Cebu UPLB PAGASA-CO PAGASA-Baguio DICT-Marawi and MSU-Marawi GovNet Pampanga DICT-Cebu GRS Davao and DICT Davao DICT- Quezon City UP CSC CO DICT-Butuan DICT-Legazpi UPV Miag-ao Malayan Colleges Laguna OCD PSU Converge for IPL-Japan link HOR UP SHS Baler UPV Tacloban CLSU
COARE Facility (Computing and Archiving Research Environment)	Provision of facilities for High Performance Computing, Science Cloud, and Data Archiving	Various institutions from the government, and academe including LGUs and international organizations (i.e., International Rice Research Institute, The Washington Post, University of Sydney, NAMRIA, Sugar Regulatory Administration, Philippine Genome Center, NGCP, Municipality of Balayan, Provincial Government of Aklan, De La Salle University, National University-Manila, UP Diliman, Benguet State University, among others)

	Technical Services Rendered	Client / Beneficiaries
EPDC (Electronic Product Development Center)	Provision of the following EPDC services: ELECTRONICS PRODUCT PROTOTYPING: · Electronics Circuit Design *PCB Prototyping: PCB Fabrication; PCB Assembly *Product Prototyping: 3D CAD; 3D Scanning; 3D Printing ELECTROMAGNETIC COMPATIBILITY TESTING: EMI Pre-Compliance Testing *RF Conducted Emission (CISPR 11 / 13 / 14-1 / 15 / 22 / 25) *RF Radiated Emission (CISPR 11 / 13 / 14-1 / 15 / 22 / 25) *Harmonics and Flicker Testing (IEC 61000-3-2 and IEC 6	Academic sector (5) Private sector (14)
	OTHER TEST SERVICES: *RoHS Testing (Handheld XRF Analyzer) *Thermal Imager (Industrial-Commercial Thermal Imager) *Parametric Testing: Advanced measurement and analysis; Fast data acquisition	Academic sector (7) Private sector (14)
PEDRO Center (Philippine Earth Data Resource and Observation)	Provision of raw satellite images	Bicol University (Bicol) Municipality of Matuginao (Samar) UP Diliman (NCR) DHSUD - IVA / Central (TAAL Volcano -DHSUD planning) DOST- CALABARZON / SLSU (CHERM) - San Nicolas, Agoncillo, Laurel LGUs (CALABARZON) UP Cebu (Metro Cebu) DPWH Central Office (Lower Bicutan - Calamba) Manolo Fortich Municipal Office, Bukidnon UP Los Baños, Lagun DPWH and ARUP DA-BSWM Mines and Geosciences Bureau

Technical Services Rendered		Client / Beneficiaries
Weather Data from DOST-ASTI-Developed Weather Stations	Provision of weather data	UP IESM Philippine Coconut Authority UP Diliman Mapua University Philippine Red Cross DOST PAGASA Tagum-Libuganon UP Diliman -NGSE / TCAGP Central Research Institute of Electric Power Industry / Hokkaido University University of San Carlos UPLB Bulacan State University DA-RFO V MOST-BARMMAscott Inc. / Baguio LGU Ramboll / Baguio LGU Hokkaido University UPD-NHRC

DOST-ASTI Personnel

Table 5. *DOST-ASTI Personnel Profile (Regular and Non-Regular Staff)*

Category	Regular	Non-Regular (Direct Hire and Outsourced Staff)	% Distribution
Headcount Total Number of Personnel	81	121	100%
By Job Function			
Administration and Management	37	57	47%
Technical	44	64	53%
By Gender			
Male	45	58	51%
Female	36	63	49%
By Age Group			
20 years old and below	0	0	-
21-30	22	104	62.4%
31-40	35	12	23.3%
41-50	17	4	10.4%
51-60	6	1	3.5%
60 years old and over	1	0	0.5%
By Educational Attainment			
With PhD	0	0	-
Master's Degree	23	5	14%
Bachelor's Degree	46	110	77%
Others	12	6	9%
By Field of Research Work			
Natural Science	0	1	0.50%
Engineering and Technology	52	71	60.8%
Agricultural Science	2	6	3.9%
Social Science	13	23	17.8%
Others	14	20	16.8%

Intellectual Properties Filed / Granted

Table 6. *Intellectual Properties filed and granted for 2020*

Title of Intellectual Property	Application / Registry No.	Type of IP	Name of Researcher / Author	Status	Date Filed	Date Registered	Applicant / IP Owner
Automated Weather Station (AWS)	3 / 2020 / 050747	Industrial Design	Gerwin P. Guba Ian C. Mosquera	Filed	15 December 2020	Registration in process	DOST-ASTI

Title of Intellectual Property	Application / Registry No.	Type of IP	Name of Researcher / Author	Status	Date Filed	Date Registered	Applicant / IP Owner
Tsunami Early Warning System (TEWS)	3 / 2020 / 050746	Industrial Design	Gerwin P. Guba Ian C. Mosquera	Filed	15 December 2020	Registration in process	DOST-ASTI
Meteorological Data Acquisition Stations for Information Dissemination	1 / 2020 / 050333	Patent	Alvin E. Retamar Gerwin P. Guba Harold Bryan S. Paler Glenn Vincent C. Lopez Ian C. Mosquera Jericho Capito Jasmin Jane Yabut Marjon de Paz Jeanette B. Carlos	Filed	09 September 2020	Registration in process	DOST-ASTI
System and Method for Real Time Participatory Data Collection	1 / 2020 / 0502079	Patent	Dr. Joel Joseph Marciano Jr. Roxanne S. Avinante John Kevin Abonita Michelle Neverida Elson Crisologo Jr. Rother Jay B. Copino	Filed	24 August 2020	Registration in process	DOST-ASTI
Kooha (Owl logo)	4 / 2020 / 506920; 4 / 2020 / 506924; 4 / 2020 / 506930	Trademark	DOST-ASTI	Registered	30 June 2020	10 January 2021	DOST-ASTI
Kooha (logo)	4 / 2020 / 506941; 4 / 2020 / 506942; 4 / 2020 / 506944	Trademark	DOST-ASTI	Registered	30 June 2020	10 December 2020 / 10 January 2021	DOST-ASTI
Kooha (Pin Logo)	4 / 2020 / 506953; 4 / 2020 / 506954; 4 / 2020 / 506955	Trademark	DOST-ASTI	Registered	30 June 2020	10 December 2020 / 10 January 2021	DOST-ASTI
Kooha (Wordmark)	4 / 2020 / 506960; 4 / 2020 / 506961; 4 / 2020 / 506962	Trademark	DOST-ASTI	Registered	30 June 2020	10 January 2021	DOST-ASTI
ERP Procurement System (Computer Program)	CO2020 / 03	Copyright	John Mayson Labuntog Ma. Theresa Layosa Jerald Vincent Leyva Onion George Quimsun Qyle DLA San Juan Pedrito Mangahas Rene Mendoza Juvy Baraquio Antonio Bravo Kate Cervantes Kristine Cervantes Danielle Dolom Camille Larios Wendy Manuel Rene Jane Rosendo Corazon Valdez	Registered	15 June 2020	02 September 2020	DOST-ASTI
ERP Procurement System (User Manual)	CO2020 / 97	Copyright	Danielle Dolom Camille Larios Andrea Erin Esguerra	Registered	15 June 2020	02 September 2020	DOST-ASTI

Title of Intellectual Property	Application / Registry No.	Type of IP	Name of Researcher / Author	Status	Date Filed	Date Registered	Applicant / IP Owner
ERP Procurement System (Technical Documentation)	CO2020 / 99	Copyright	Girlie Fernandez John Mayson Labuntog Ma. Theresa Layosa Jerald Vincent Leyva Onion George Quimsun Qyle DLA San Juan	Registered	15 June 2020	02 September 2020	DOST-ASTI
ERP Procurement System (API Documentation)	CO2020 / 98	Copyright	Girlie Fernandez John Mayson Labuntog Ma. Theresa Layosa Jerald Vincent Leyva Onion George Quimsun Qyle DLA San Juan	Registered	15 June 2020	02 September 2020	DOST-ASTI
System and Method in Feature Detection in Satellite Images using Neural Networks	1-2020-050067	Patent	Joel Joseph S. Marciano Jr. Roel M. Dela Cruz Nestor T. Olfindo Jr. John Keithley I. Difuntorum Machele M. Felicen Marion Clarisse L. Gerido	Filed	06 April 2020	Registration in process	DOST-ASTI
A System and Method to Create Vegetation Maps from Satellite Images using Neural Networks	1-2020-040048	Patent	Joel Joseph S. Marciano Jr. Roel M. Dela Cruz Nestor T. Olfindo Jr. Noel Jerome B. Borlongan	Filed	27 February 2020	Registration in process	DOST-ASTI
SIYASAT (Word Mark)	4 / 2020 / 003896	Trademark	DOST-ASTI	Filed	12 March 2020	Registration in process	DOST-ASTI
SIYASAT (Figurative Mark)	4 / 2020 / 003895	Trademark	DOST-ASTI	Filed	12 March 2020	Registration in process	DOST-ASTI

Technical Training Conducted

Table 7. *Includes Workshops, Conferences, Technical Trainings / Lectures*

Title of Trainings Conducted	Date Conducted	No. of Participants
AI4CAF (Artificial Intelligence for Census on Agriculture and Fisheries) Training Series Session 1: NovaSAR and SIYASAT Portal Demo	21 July 2020	Philippine Statistics Authority (PSA) Representatives
AI4CAF Training Series Session 2: Basics of SAR	05 August 2020	PSA Representatives
Conduct of AI4CAF Training Series Session 3: Object Identification using AI	20 August 2020	PSA Representatives
AI4CAF Training Series Session 4: Presentation of AI Output	03 September 2020	PSA Representatives
Hydromet Stations Maintenance and Troubleshooting	18-21 February 2020	31
Hydromet Stations Maintenance and Troubleshooting	25-28 February 2020	33
Artificial Intelligence for Earth Observation (AI4EO) Training for NAMRIA	03-07 February 2020	27
AI4EO Training for PSA	02-06 March 2020	24
PastTrack end-user training, Apr. 27, 2020, 27 part.	27 April 2020	27

Title of Trainings Conducted	Date Conducted	No. of Participants
NetMesh Benchmarking Online Training for NTC RO I, CAR, IV-A, IX (4)	3rd Quarter	NTC Representatives
Training conducted: Spectrum Analyzer, Oct. 19-20, 2020; 3 participants (1 client)	19-20 October 2020	3

Scientific Papers Published / Presented

Table 8. *Peer-Reviewed Papers*

Title of Scientific Paper	Author	Title of Conference	Name of Publication Journal
Sugarcane Plantation Mapping Using Dynamic Time Warping from Multi-temporal Sentinel 1-A Radar Images (Annals)	Nestor T. Olfindo, Jr. Roel M. de la Cruz Noel Jerome B. Borlongan Joel Joseph S. Marciano, Jr. Laverne C. Olalia (SRA)	Presented via Zoom during the XXIV ISPRS Congress held from 08 / 31 / 2020 to 09 / 02 / 2020	ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences; Volume V-3-2020; ISPRS Ann. Photogram. Remote Sens. Spatial Inf. Sci., V-3-2020, 519–524; Published by the International Society for Photogrammetry and Remote Sensing. 03 August 2020
Near-real-time Flood Detection from Multi-temporal Sentinel Radar Images using Artificial Intelligence (Archives)	Roel M. De La Cruz Nestor T. Olfindo, Jr. Machele M. Felicen Noel Jerome B. Borlongan John Keithley L. Difuntorum Joel Joseph S. Marciano Jr.	Presented via Zoom during the XXIV ISPRS Congress held from 08 / 31 / 2020 to 09 / 02 / 2020	The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences; Volume XLIII-B3-2020; Published by the International Society for Photogrammetry and Remote Sensing. 22 August 2020
Correcting Job Walltime in a Resource-Constrained Environment	Jessi Christa Rubio Aira Villapando Christian Matira Jeffrey Aborot	-	Lecture Notes in Computer Science; ISSN 0302-9743; Vol. 12082; Published by Springer, Cham
LoRa-based Mesh Network for Off-grid Emergency Communications	Calvin Artemies G. Hilario	-	2020 IEEE Global Humanitarian Technology Conference (GHTC); ISSN 2377-6919; Vol. 2020 No. 9342944; Published by the Institute of Electrical and Electronics Engineers Inc. (IEEE)
LokaLTE: 600 MHz Community LTE Networks for Rural Areas in the Philippines	Calvin Artemies G. Hilario Mar Francis D. De Guzman Ramon Vann Cleff B. Raro Jean Jay J. Quitayen Joel Joseph S. Marciano, Jr., Ph.D.	-	2020 IEEE Global Humanitarian Technology Conference (GHTC); ISSN 2377-6919; Vol. 2020 No. 9342849; Published by Institute of Electrical and Electronics Engineers (IEEE)
Earth Observation Applications for Goal 14: Improving Maritime Domain Awareness Using Synthetic Aperture Radar Imaging with Automatic Identification System in the Philippines	Vicente, Rocell Nino B. Retamar, Alvin E. Tabanggay, Lianne Maxine A. Rayo, Joshua Frankie B. Mina, Katrina T.	-	The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences; ISSN 1682-1750; Vol. XLIII-B3-2020; Published by Copernicus Publications

International Scientific Linkages and Networks

Table 9. *Includes collaboration thru S&T information exchange, R&D collaboration, provision of funding / facilities, and others*

Name of Institution	Location / Country	Nature / Description of Scientific Linkages
Ministry of Agriculture, Fisheries and Forestry Information Network (MAFFIN)	Japan	MAFFIN provides funding support for the establishment and maintenance of the Philippines' link to the Asia-Pacific Advanced Network (APAN)
Keio University	Japan	SOI Asia (School of Internet-Asia) Asian Internet Interconnection Initiatives (AI3) Trainings Information exchange

Name of Institution	Location / Country	Nature / Description of Scientific Linkages
TEIN* Cooperation Center (TEIN*CC) on behalf of EU	Republic of Korea	International research and education connectivity and collaboration between Europe and Asia Trainings and other capability building initiatives Information exchange
Asia Pacific Network Information Centre (APNIC)	Australia	Internet operation and management Regional networking activities Training Information exchange
Pacific Rim and Grid Middleware Assembly (PRAGMA)	USA	S&T Information Exchange through Grid Forum DOST-ASTI as a member institution
ASEAN Committee on S&T (COST)	ASEAN Countries (DOST as Philippine counterpart)	S&T Information Exchange through the conduct of / attendance to conferences, S&T exhibition, and collaborative activities between member-countries DOST-ASTI as member of SCMIT (Sub-committee on Microelectronics and Information Technology)
APAN (Asia and Pacific Advanced Network), Ltd.	Singapore (APAN secretariat c / o SingAREN)	Participation and promotion of activities relating to the development and deployment of next-generation networking / Internet technology applications and services in research and education, and encouraging the interconnection of advanced networks
National Center for High Performance Computing (NCHC)	Taiwan	S&T Information Exchange through attendance to trainings
Japan International Cooperating Agency	Japan	SATREPS-ULAT Project
International Rice Research Institute		Use of DOST-ASTI Computing and IT facilities (HPC, COARE, PREGINET)
NICT (National Institute of Information and Communication Technology)	Japan	HIMAWARI (with DOST-PAGASA and DOST-PHIVOLCS)
Hokkaido University	Japan	SATREPS-ULAT Project
MHESI (Ministry of Higher Education, Science Research, and Innovation (thru DOST-OUsec RD) / GISTDA (Geo-Informatics and Space Technology Development Agency)	Thailand	DOST-ASTI as the focal RDI for Space Techology and Application
UP Diliman	Philippines	Katunog project
Philippine Space Agency (PhilSA)	Philippines	PEDRO, DATOS, Possible customization of ERP for PhilSA
NAMRIA	Philippines	DATOS (AI Application in mapping, AI Trainings for NAMRIA)
Philippine Statistics Authority (PSA)	Philippines	DATOS (AI Application in mapping, AI Trainings for PSA)
EAIPI	Philippines	Operation of the DOST's Electronic Product Development Center

External Resources Generated

Table 10. *Generated from external sources including DOST*

Source	Title / Description of Assistance	Value of Assistance
DOST-GIA	STAMINA4SPACE Project 5: Advanced Satellite Development and Know-How Transfer for the Philippines	372,352,154.60
DOST-GIA	DOST-SAR AIS (Y2)	16,995,890.55
DOST-GIA	DOST-SAR AIS (Y3)	50,000,000.00
DOST-PCIEERD	Katunog project	2,020,852.54
DOST-GIA	EPDC Project 1	10,949,810.57
DOST-GIA	EPDC Project 2	3,174,099.18
DOST-GIA	DOST-GRASPED Y2	10,018,225.13
DOST-PCIEERD	DOST-IDAS	157,694.40
DOST-GIA	DOST-Setting up of One Stop Lab Services for Global Competitiveness Phase 2	429,579.64
DOST-GIA	DOST-ULAT Y2	1,811,753.65
DOST-GIA	DOST-Project 2 EPDC-EPIIC Y2	3,174,099.18
Service Clients	EPDC services	1,614,413.40
Service Partners	PREGINET network connection subscriptions	4,542,622.71
LGU Lebak, Sultan Kudarat	LGU Lebak, Sultan Kudarat- Fabrication of 2 units Alerting Station (300,000	300,000.00

Source	Title / Description of Assistance	Value of Assistance
Ace Electronics Corp.	Royalty from arQ licensing (agency share)	79,088.00
Ace Electronics Corp.	Royalty from arQ licensing (researcher share)	115,392.00
TOTAL		**477,735,675.55**

Glossary

Acronym	Description
AdZU	Ateneo de Zamboanga University
AESS	Automated Electronic Survey System
AGROMET	Agrometeorological
AI	Artificial Intelligence
AI4CAF	Artificial Intelligence for Census on Agriculture and Fisheries
AI4EO	Artificial Intelligence for Earth Observation (AI4EO)
AI4Mapping	Artificial Intelligence for Mapping
ARG	Automated Rain Gauge
DOST-ASTI	Advanced Science and Technology Institute
ASTIEA	ASTI Employees Association
AWS	Automated Weather Station
BSWM	Bureau of Soils and Water Management
CLSU	Central Luzon State University
COARE	Computing and Archiving Research Environment
CSC CO	Civil Service Commission Central Office
DA	Department of Agriculture
DA-FPOPD	DA-Field Programs Operational Planning Division
DA-RFO	DA-Regional Field Office
DEWS	Disaster Early Warning System
DHOs / MHOs	District Health Offices / Municipal Health Offices
DHSUD - IVA	Department of Human Settlements and Urban Development - Region IVA
DICT	Department of Information and Communications Technology
DOST	Department of Science and Technology
DOST- CALABARZON / SLSU (CHERM)	DOST - DOST Cavite, Laguna, Batangas, Rizal, Quezon / Southern Luzon State University (Center for Hazard and Environmental Resource Mapping)

Acronym	Description
DOST CO	DOST Central Office
DOST-PAGASA	DOST-Philippine Atmospheric, Geophysical and Astronomical Services Administration
DOST-PCIEERD	DOST-Philippine Council for Industry, Energy, and Emerging Technology Research and Development
DOST-PHIVOLCS	DOST-Philippine Institute of Volcanology and Seismology
DPWH	Department of Public Works and Highways
DRR	Disaster Risk Reduction
DRRMO	Disaster Risk Reduction and Management Officer
EAIPI	Electronic Industries Association of the Philippines, Inc.
EO data	Earth Observation data
EPDC	Electronics Product Development Center
ERP	Enterprise Resource Planning
EU	European Union
EULA	Enduser Licensing Agreement
GRS	Ground Receiving Station
HOR	House of Representatives
HPC	High Performance Computing
HSP	Hepatology Society of the Philippines
IEC	Information Education Campaign
IP	Intellectual Property
ISPRS	International Society for Photogrammetry and Remote Sensing
LGU	Local Government Unit
MASID	Meteorological data Aquisition Stations for Information Dissemination
MDRRMO	Municipal Disaster Risk Reduction and Management Office
MOST-BARMM	Ministry of Science and Technology - Bangsamoro Autonomous Region in Muslim Mindanao

Acronym	Description
MSU	Mindanao State University
NCR	National Capital Region
NICT	National Institute of Information and Communication Technology
NSTW	National Science and Technology Week
NTC	National Telecommunications Commission
OCD	Office of Civil Defense
PAASE	Philippine-American Academy of Science and Engineering
PAFP	Philippine Academy of Family Physicians
PAGASA-CO	PAGASA Central Office
PALES	Philippine Association of Laparascopic and Endoscopic Surgeons
PAPRAS	Philippine Association of Plastic Reconstructive and Aesthetic Surgeons
PCARI	Philippine-California Advanced Research Institutes
PCS	Philippine College of Surgeons
PDRRM	Provincial Disaster Risk Reduction and Management
PDRRMC	Provincial Disaster Risk Reduction and Management Council
PhilRice-PRISM	Philippine Rice Research Institute - Philippine Rice Information System
PhilSA	Philippine Space Agency
PhilSPEN	Philippine Society for Parenteral and Enteral Nutrition
PREGINET	Philippine Research Education, and Government Information Network
PSA	Philippine Statistics Authority
PSGS	Philippine Society of General Surgeons
PSTC	Provincial Science and Technology Center
PSU	Pangasinan State University
PTA	Philippine Thyroid Association
RDIs	Research and Development Institutes

Acronym	Description
RO	Regional Office
SRA	Sugar Regulatory Administration
STAMINA4Space	Space Technology Applications Mastery, Innovation, and Advancement
TEMDEC	Telemedicine Development Center of Asia
TEWS	Tsunami Early Warning System
TNP	Telemedicine Network of the Philippines
ULAT	Understanding Lightning and Thundertorms
UND	Understanding of Natural Disaster
UP	University of the Philippines
UP IESM	UP Institute of Environmental Science and Meteorology
UP SHS Baler	UP Science High School - Baler
UPD DGE/COE	UP Diliman Department of Geodetic Engineering/Colleage of Engineering
UPD NGSE/TCAGP	UP Diliman National Graduate School of Engineering / Training Center for Applied Geodesy and Photogrammetry
UPD-NHRC	UP Diliman National Hydraulic Research Centre
UPLB	UP Los Baños
UPV Miag-ao	UP Visayas Miag-ao
UST	University of Santo Tomas
WLMS	Water Level Monitoring Station

Directory

Key Officials

Alvin E. Retamar
Officer-In-Charge

Email: *ning@asti.dost.gov.ph*
Email: *ea@asti.dost.gov.ph*
Direct Line: +63 2 8426 9755

May C. Cayaban
Chief Administrative Officer
Finance and Administrative Division (FAD)

Email: *may@asti.dost.gov.ph*
Direct Line: +63 2 8426 7423

Peter Antonio B. Banzon
Chief Science Research Specialist
Research and Development Division (RDD)

Email: *peterb@asti.dost.gov.ph*
Direct Line: +63 2 8426 3572

Rene C. Mendoza
Chief Science Research Specialist
Knowledge Management Division (KMD)

Email: *rene@asti.dost.gov.ph*
Direct Line: +63 2 8927 3093

Alvin E. Retamar
Chief Science Research Specialist
Solutions and Services Engineering Division (SSED)

Email: *ning@asti.dost.gov.ph*
Direct Line: +63 2 8426 3572

Joanna G. Syjuco
Chief Science Research Specialist
Computer Software Division (CSD)

Email: *joan@asti.dost.gov.ph*
Direct Line: +63 2 8426 3694

Contact

Address:
DOST-ASTI Bldg., UP Technology Park Complex
C.P. Garcia Avenue, Diliman, Quezon City
Philippines 1101
Trunkline: +63 2 8249 8500, +63 2 8426 9755
Email: **info@asti.dost.gov.ph**

Technology Licensing Office

Email: *tlo@asti.dost.gov.ph*
Local: 1603

Bids and Awards Committee Secretariat (BAC Secretariat) /
Procurement Management Section

Email: *bac-sec@asti.dost.gov.ph*
Local: 1206, 1212

Property and Supply Section

Email: *propertyandsupplysection@asti.dost.gov.ph*
Local: 2007

Publication Staff

Editor-in-Chief — Joel Joseph S. Marciano, Jr., Ph.D.

Associate Editors — Narcisa Juvilyn C. Castañeda
Anna Korina C. Asunto
Kristelle Nicole G. Chavez

Writers — Alexis Niño H. Almasan
Maria Irene S. Amatorio
Glenda Mae E. Baldonado
Emmanuel P. Balintec
Abegail F. Bactol
Reynaldo Joseph A. Callao, Jr.
Jayson C. Hernandez
Chrislee A. Javier
Emma P. Juco
Camille L. Larios
Charmaine Ann S. Manalo
Mitz Ann N. Montañez
Mylene N. Monton
Mary Jane E. Ocasla
Vanessa O. Osiana
Mary Joy Daphne P. Padilla
Jervic Lexter N. Perlas
Vhander T. Ramos
Paul John M. Serrano
Rocell Niño B. Vicente

Art Director — Pedrito B. Mangahas

Cover Design — Aldrin M. Ramos

Graphics Design — Kristelle Nicole G. Chavez
Aldrin M. Ramos
Mark Louie V. Lucero

Publisher — DOST Advanced Science and Technology Institute

Year — 2020